



## Energy Planning and Project Procedures in Zambia

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# Energy Planning and Project Procedures in Zambia

John M. Christensen

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ENERGY PLANNING AND PROJECT PROCEDURES  
IN ZAMBIA

John M. Christensen

Abstract. The energy situation in Zambia is described in detail following a general introduction to the Zambian society. The contribution of the different commercial and woodfuel energy sources to the energy supply in the different sectors is analysed and policy options outlined.

The political and administrative structures especially within the energy sector are presented, and the existing formal and informal project handling procedures are analysed.

The present situation is generally characterized by limited Zambian influence on project analysis and selection, while foreign donor interests are found to have great impact through very early involvement in the identification and preparation phases.

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## CONTENTS

	Page
PREFACE .....	5
1. INTRODUCTION .....	7
2. THE ECONOMIC SITUATION .....	9
2.1. Basic structures .....	9
2.2. Development aims and realities .....	10
2.3. The agricultural sector .....	11
2.4. Migration to urban areas .....	14
2.5. Recent changes .....	14
3. THE ENERGY SITUATION .....	16
3.1. Introduction .....	16
3.2. Commercial energy sources .....	18
3.3. Woodfuels .....	35
3.4. Other biomass and renewable sources .....	47
4. POLITICAL AND INSTITUTIONAL STRUCTURES .....	49
4.1. Historical and political background .....	49
4.2. Political and administrative organisation .....	51
4.3. National development planning .....	53
4.4. The parastatal system .....	55
5. ENERGY SECTOR INSTITUTIONS .....	59
5.1. Introduction .....	59
5.2. Central administration .....	60
5.3. Parastatal corporations .....	69
5.4. Advisory bodies .....	72
5.5. Research and development institutions .....	74
5.6. SADCC cooperation .....	75
6. PROJECT PROCEDURES .....	76
6.1. Introduction .....	76
6.2. Project ideas .....	78
6.3. Formal project procedures .....	80
6.4. Practical project procedures .....	82
6.5. Analysis methods and criterias .....	86

	Page
7. CONCLUDING REMARKS .....	90
REFERENCES .....	93

#### Abbreviations used

ANC	: African National Congress
CAPCO	: Central African Power cooperation Company
CPC	: Copperbelt Power Company
DNR	: Department of Natural Resources
DOE	: Department Of Energy
ESA	: Energy Sector Assessment programme
FAO	: Food and Agricultural Organisation
FD	: Forestry Department
FNDP	: Fourth National Development Plan
IMF	: International Monetary Fund
INDECO	: INdustrial DEvelopment Corporation
LEAP	: Less developed countries Energy Alternatives Planning system
MINDECO	: MINing DEvelopment Corporation
MPTC	: Ministry of Power, Transport and Communications
NCDP	: National Commission for Development Planning
NCSR	: National Council for Scientific Research
NEC	: National Energy Council
SADCC	: Southern African Development Coordination Conference
TDAU	: Technology Development and Advisory Unit
TNDP	: Third National Development Plan
UHRED	: Urban Household and Rural Energy Development
UNDP	: United Nations Development Programme
UNIDO	: United Nations Industrial Development Organization
UNIP	: United National Independence Party
UNZA	: UNiversity of ZAmbia
WB	: World Bank
ZAFFICO	: ZAmbia Forestry and Forest Industries Corporation
ZCCM	: Zambia Consolidated Copper Mines
ZESCO	: Zambia Electricity Supply Corporation
ZIMCO	: Zambia Industrial and Mining Corporation
ZNEL	: Zambia National Energy Ltd.

## PREFACE

This volume is the second in the series of reports presenting the results of the Ph.D. study - Methods for Assessment of Rural Energy Projects in Developing Countries - currently being performed at the Systems Analysis Department, Risø National Laboratory in collaboration with the Department of Energy (DOE) in Zambia and with the Institute of Mathematical Statistics and Operations Research at the Technical University of Denmark.

While the first report gave a short macro-level introduction to the Zambian society but focused on a presentation of the detailed micro-level results of an energy survey jointly performed with DOE mid-1985, this volume is focused on the macro-level, giving a description and an analysis of the national energy situation, the administrative structures at the state, province and district levels and the various bodies' roles and activities in relation to energy supply and consumption. Special focus is put on how energy projects, especially those aimed at rural areas, are initiated, analyzed and selected.

The first and second report form the empirical basis for the theoretical discussions of project analysis methods and the outline of a new practical approach, which is the subject of volume 3.





## 1. INTRODUCTION

In 1964 when Zambia gained independence almost all commercial energy supplies were imported mainly through Southern Rhodesia (Zimbabwe). This situation has changed significantly since then due to large investments especially within the power sector, where the large hydro power stations at Kafue and Kariba North are the dominant examples. This development - partly forced by political developments in the surrounding countries - has led to a situation where Zambia has a large surplus of hydropower and at least currently is a net exporter. However, oil products are still solely imported, and although the consumption of oil products has been slightly decreasing for the last decade the steep price increases in the mid-seventies and in 1979/1980 brought energy supply in political focus in Zambia as well as in the rest of the world. In fact the costs of oil imports until the recent drop in prices represented about 20% of the total imports compared with about 8% in the early seventies. As it is described in detail in chapter 5, this leads to the establishment of separate institutions dealing with energy policy and planning, and a large number of projects have been executed or prepared aiming at conservation, oil substitution with domestic electricity, rehabilitation and extension of distribution and transmission installations etc.

All these changes and developments have almost totally focused on the commercial energy consumption especially within the mining and the industrial sectors in order to support a development here, and at the same time reduce the high costs of the imported fuels.

The majority of the population both in the rural areas and the poorer parts of the towns have, however, not been directly affected by these changes. Their energy needs are almost totally based on the use of wood either directly as firewood or as charcoal, and only slowly within the last decade has the importance,

magnitude and implications of this consumption been politically recognized. Even today, where estimations say that more than half of the country's energy consumption is based on wood, the interest devoted to the energy supply of the household sector both urban and rural is very limited. This situation is not in any way unique for Zambia, it applies to most African countries south of the Sahel area, and although the description in this report deals solely with Zambia, many of the problems discussed are similar for a large number of countries especially regarding household and woodfuel issues. This is also why the discussions about appropriate project analysis methods in volume 3 based on the experiences from Zambia can be expected to have some general validity.

This introduction gives only a very short summary of a long and complicated process of development resulting in the energy situation as it is in Zambia today. An adequate description would probably require a whole volume of its own, and since this project also focuses on administrative structures and projects analysis within the energy sector, it has been necessary to limit this description to the present situation. In chapter 2 the most recent developments within the Zambian society are outlined as a background for a more comprehensive presentation and analysis of the present energy situation, which is given in chapter 3. The general public administrative structures and parastatal organisations are described in chapter 4 along with an attempt to clarify the relations between and the responsibilities of the various bodies. The institutions active within the energy sector are presented in greater detail in chapter 5 with emphasis on the Department of Energy. In chapter 6 both the formal and informal procedures for project initiation, analysis, selection and financing are described. Some more general and concluding remarks are given in chapter 7.

## 2. THE ECONOMIC SITUATION

### 2.1. Basic structures

The Zambian society is today still dominated by the fact that the economy is very heterogeneous like in many other developing countries. The development efforts have mainly followed an export oriented strategy based almost entirely on one single commodity - copper. The still very small industrial sector has predominantly been oriented towards supporting the copper mines. The agricultural development has favoured the commercial farms that mainly produce cash-crops for the larger urban markets and on a limited scale also for export. Still the large majority of the agricultural sector consists of very small farms, where the families are mainly subsistence producers, but some are able to grow a small surplus for sale at the local market.

This structure was largely inherited at independence, and even after more than twenty years, the dependency on the copper production is still overwhelming, and it has naturally got implications on most aspects of the society.

An obvious example is infrastructure development, which has been very heavily focused on the needs of the mining sector and of the connected urban centers. The result has been continued development around the historical "line of rail" going from the Copperbelt area in the mid-north through the capitol Lusaka down to Livingstone in the south as a gateway to the other parts of Southern Africa. Roads, railways, and power supply were and still are designed to support and develop the central regions around this "line of rail". A result of this infrastructure development has also been that new industries, commercial farms, etc. also have chosen to locate close to these facilities, and in that way making it even more necessary for the government to give priority to further development in these already fairly modern regions.

This focus on the central provinces also means that very little effort has been devoted to creating a more coherent and balanced development between the rural areas dominated by subsistence farmers and the urban based industrial and mining sectors.

## 2.2. Development aims and realities

The government has since the launching of the First National Development Plan (FiNDP) in 1966 had the main aims to

- diversify economy to reduce reliance on copper
- minimize the inherited economic imbalance between the urban and the rural sectors
- raise the general level of education
- increase social welfare.

Looking at the results, it is evident that considerable development has been reached with regard to the two latter aims, although some of the early achieved results have deteriorated in the last decade. The two first aims have, however, been more difficult to fulfil, and in spite of the official aims, the development efforts have as described been highly oriented towards securing the export of copper.

There are a number of factors which explain the achievement of good results in some areas and lack of results in others. In the following a few of these factors will be outlined briefly.

During the first decade after independence the general economic development was characterized by high copper prices providing the basis for positive growth rates. In spite of the official political aims about 80% of the government investments during the period of the FiNDP (1966-70) went into projects in the three line of rail provinces in order to strengthen development here instead of, as officially stated, to devote the majority of funds to rural development and diversification. However, notable results were achieved in campaigns against illiteracy, disease eradication, etc.

The lack of success in the diversification process became unpleasantly evident, when the impact of the world economic recession in the mid-seventies resulted in a sharp decrease in copper prices of about 40-50%. Due to the dependency on one single export commodity, the impact could not be compensated by other products. Combined with the rapidly rising oil price and political instability in Angola and Rhodesia, resulting in the closing of the cheapest routes for the transport of foreign trade, it meant virtually a collapse of the Zambian economy.

The copper mines, which remain the only major earner of foreign exchange representing about 94% of Zambian exports, had to be adjusted to a situation with falling prices, increasing costs of both transport and all foreign input, energy supply etc. This made it necessary again to devote the majority of government funds to rehabilitation of the mines and to the completion of infrastructure projects mainly in transport and commercial energy in order to lower production costs at the mines and reduce imports.

Although the political recognition of the need for rural development and a greater diversification in both industry and agriculture had grown, it was not possible to make any great new efforts. The economic situation naturally meant that the resources for development were very limited, but equally important was that the interests of the industrial and mining companies, the political importance of the urban population compared to the rural all are factors that strongly influence the actual policy execution.

### 2.3. The agricultural sector

The initiatives that have been aiming at agricultural development until now can best be described in relation to a short examination of the structure of the sector.

It has been estimated that there are around 600,000 farmers in Zambia. Approximately 4% are basically commercial farms in two

distinct groups. The first consists of around 1,000 highly mechanized large size farms of an average of 60 ha, and the other of a large group of middle size farms based on a lower level of mechanization and with an average area of 5 ha cultivated. These two groups together produce 40-50% of the total marketed agricultural produce. It has been regarded as a political necessity to support this basis for the food supply to the large urban areas, and this has been done through improvements of the infrastructure, provision of cheap inputs like fertilizer, crop research and securing sales prices through subsidizing consumer prices on the basic products. The high Zambian level of urbanization is unique compared to most other African countries.

In contrast to the commercial farmers are the subsistence farmers based on the traditional slash and burn/chitemene agriculture system, where small land areas are cleared, and cultivated as long as they are fertile. When fertility decreases the activity is moved to a new area which has been cleared, etc. The subsistence system is based entirely on family labour and only simple hand tools are used to cultivate about 1 ha or so at a time.

Production is almost entirely for the family itself, and if a small surplus is generated, it is sold at the local market. It is difficult to give a precise figure for the number of subsistence farmers in Zambia, but a rough estimate is 450,000 or approximately 75% of the total number of farmers. The main recent government initiatives to support this large group of farmers have been taken through the Integrated Rural Development Programmes (IRDP) mainly funded by foreign donors. The main activity in the IRDP concerning agricultural development is the so called Lima-programme, where the small farmers are urged to increase their cultivated land in order to produce a surplus for sale (a lima is 1/4 ha). Support is given through credit schemes, seeds supply, organizing of surplus sales etc.

The remaining 21% of the farmers constitute a group which traditionally also was categorized as a sort of large subsistence farmers. In recent years the group has been defined separately in order to understand and support their development properly. This is probably also the reason why they have been named "emergent farmers". They are characterized by having a larger cultivated area of about 2-4 ha, and the majority of their production is marketed. They are still based on family labour, but often hire additional help, and although they are based on traditional tools, some mechanization can be seen. Within the last few years government policy has been to give increasing support to the emergent farmers, because they are seen as an appropriate level for further development. Their production methods are still labour intensive with a low level of mechanization but they use more modern farming methods and fertilizer, irrigation, etc. which means that they are not relying on the slash and burn technique, but can continue to use the same fields for a longer period. In this way they increase yields without any demand for large investments. Support to this large group of farmers has been given in various way like credit schemes, crop pricing, research etc.

The four main categories of farmers described above naturally do not constitute homogeneous groups, and transitional forms exist. But they represent the four dominant productions modes.

The process of changing the structure of the agricultural sector and increasing output is, however, slow, but further development within the sector and in the rural areas in general is absolutely necessary, because a more intensive use of the vast natural land resources is probably one of the most important aspects of the diversification that is an essential part of any future coherent development process.

#### 2.4. Migration to urban areas

The very slow development in the rural areas has also been a driving force in the continued migration to urban areas.

Due to the early urban concentration around the mines in the Copperbelt area, Zambia has experienced a long period of growing migration, but even after the recession in the mid-seventies, this drive especially of young men, towards the cities has continued, even though employment possibilities within the formal economy in reality now are very poor. This leaves many rural areas short of male labour and is reflected in a high proportion of female headed households. Inevitably this also limits the development potential, and indirectly helps to keep the migration process going.

It has been estimated that the urban population now is very close to 50% of the total, which is among the highest in Africa, and it is still growing. A figure that emphasizes the need for increased domestic food production, and shows how difficult it is to change directions in a development process.

#### 2.5. Recent changes

On top of and partly as a result of the structural crisis, Zambia is now facing a situation, where the foreign debt has reached an unmanageable size. Up till late 1985 this was handled through continued rescheduling of debt payments and tight restrictions on the purchase of foreign exchange leading to several shortages of spare parts, new machinery etc. but maintaining a moderate inflation. In October 1985 the Government introduced a new auctioning system for foreign exchange as part of an agreement with the IMF. This rapidly lead to an effective devaluation of 2-300% and a very high inflation even affecting products without any real foreign components in the price.



After a short period of moderate stability in the exchange rate early 1986, it has decreased in value by more than 10% per week through most of summer and autumn 1986 and by the end of the year 1 US\$ was equal to about 14-15 kwacha compared with 2-3 kwacha before the auctioning started. A number of measures were introduced to hold the slide of the kwacha, but these had only temporary effect. The rate of exchange finally reached the value of US\$ 1 = K 21 in late April 1987, at which time the auctioning system was abandoned, and the rate fixed at US\$ 1 = K 8.

The medium term impact of these changes has been a large increase in the import of e.g. luxury products and a raise in the cost of living affecting especially the middle and low income urban inhabitants.

The long term effects remain still to be seen.

The described developments within the last years have also lead to drastic changes within the energy sector, but it is still very difficult to judge the full impact. One task that has been made extremely difficult is planning, and the Fourth National Development Plan, (FNDP) which was prepared to be implemented in 1986 has been postponed while the plans are being reviewed according to the new but still changing situation.<sup>1)</sup>

The general situation under the FNDP period, no matter what the precise start year is, will be characterised by very scarce resources within all sectors of the economy. This means that if the necessary aims for increased rural and agricultural development are to be pursued, it will be necessary to carry out careful project planning giving high priority to the socio-economic aspects of investment analysis.

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1) It has not been possible to include the most recent developments after May 1987, where Zambia broke with the IMF imposed economic reform program, in this description.

This short introduction to the Zambian economy and some of the major development trends is intended only as a necessary background for the understanding of the situation and developments within the energy sector. It has not been the intention to explain the political background, involved class interests etc. but merely give a critical presentation of the situation.

### 3. THE ENERGY SITUATION

#### 3.1. Introduction

The described duality in the structure of the Zambian society is naturally directly reflected in energy consumption and supply structures. The usual way of distinguishing is between consumption of commercial fuels covering in Zambia petroleum products, coal/coke and electricity and on the other side the non-commercial fuels comprised of firewood, charcoal<sup>1)</sup> and other biomass and renewable resources. The commercial fuels are almost exclusively consumed in the mining and industrial sectors and for transport, while woodfuels predominantly are used in the households. This is illustrated in Table 3.1.1, where the sectoral pattern of energy consumptions is presented.

In order to understand the importance of the non-commercial fuels, the actual consumption figures in real terms for 1980 are listed in Table 3.1.2.

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1) Using the term non-commercial about charcoal is in principle wrong, since almost all charcoal is produced for sale, but the distinction here is mainly between the formal centralized commercial supplies and the informal woodfuel supply.

Table 3.1.1. Sectoral pattern of energy consumption (1980/81)

Sector	Petroleum	Coke	Coal	Electricity	Woodfuel	Bagasse
	%	%	%	%	%	%
Mining	37	100	52	73	6	-
Industry	18	-	48	17	-	100
Transport	35	-	-	-	-	-
Agriculture	1	-	-	2 <sup>1</sup> )	-	-
Others (incl. households)	9	-	-	8	94	-
Total	100	100	100	100	100	100

1) Many agrobased industries are registred as "industry" sector e.g. sugar, coffee etc.

Source: 1. Zambia National Energy Limited (ZNEL)  
2. Department of Forestry and ZESCO  
3. UNDP/WB (25)

Table 3.1.2. Total energy consumption in Zambia and energy use in the household sector in 1980

Energy sources	Amount used		Household sector consumption	
	(TJ)	(% of total)	(TJ)	(% of Energy source)
Petroleum	25,100	17.9	1,290	5.1
Electricity	20,000	14.2	835	4.2
Coal	11,800	8.4	-	-
Coke	2,400	1.7	-	-
Charcoal	11,600	8.3	11,536	99.5
Firewood	69,700	49.6	66,770	95.8
Total	140,600	100.0	80,431	57.2

Source: Chidumayo 1985 (9)

Besides illustrating especially the role of firewood, the table together with 3.1.1 also illustrates some of the divergence between the various sources of statistics on especially energy consumption but also some parts of the supply. The uncertainties involved are very large for the household and agricultural sectors with respect to both supply and consumption of non-commercial fuels.

Usually these figures are based on generalisation of small amounts of data or are average numbers based on some general experience, often guesses. This discussion on data availability and reliability will be resumed in the volume 3 report. It is only mentioned here in order to emphasize the problem and give an advance notice that may explain some of the possible inconsistencies that may occur in tables in this chapter. The ambition here has been mainly to use figures from Department of Energy and other Zambian sources, but even that will not eliminate the problem.

The following detailed presentation and analysis of the energy situation is structured by fuel type, implying that the situation is seen mainly from the supply side. It would have been more appropriate to look at the needs and therefore to start out from the consumption side but as described earlier in this section, this approach is not possible due to lack of appropriate data. The ambition is, however, to try to integrate the two approaches wherever possible.

## 3.2. Commercial energy sources

### 3.2.1. Petroleum

3.2.1.1. Supply system. All petroleum products have to be imported since Zambia has not yet got any verified oil deposits, and although exploration promotion projects recently have pointed out four land areas for further investigation, supply will in any case still have to be based solely on imports for a long period to come.

Petroleum products are bought mainly from Arabic countries through international oil companies and transported to the port of Dar-es-Salaam. The rest of the way to Zambia the product, which presently is a light crude oil spiked with selected refined products, is transported through the Tazama pipeline from Dar-es-Salaam to the Indeni oil refinery in Ndola (see Fig. 3.2.1), where the refining is done. The refined products are marketed through 5 local affiliates of international oil companies.

Through the state holding company ZIMCO, its subsidiaries and associate companies, the Zambian state is involved in all parts of transport, refining and marketing of petroleum products. Details about ZIMCO and its involvement in energy supply and consumption are given in chapter 5.

It is notable that both the pipeline and the refinery are results of the massive infrastructure investments before the mid-seventies.

3.2.1.2. Consumption patterns. Petroleum consumption has been declining for the last decade partly due to the rapid increase in prices, although this has not always been reflected directly in consumer prices. The general decline in the Zambian economy and the active measures for conservation and substitution especially within the mining sector, have also been a direct cause of the decline.

Table 3.2.1. Petroleum consumption

Year	1977	1978	1979	1980	1981	1982	1983	1984	1985
('000 T)	769	718	640	658	644	600	588	561	504

Source: DOE (12)

In Table 3.2.2 the consumption is shown for the various sectors and besides the large decrease in the consumption in the mining

sector, the drop within the service and household sectors is drastic. This drop has not been examined closer but could be expected as a result of the rising prices. In the poorer households through reduction of consumption and conservation due to lack of money and in the more wealthy households through substitution by other sources, typically electricity.

Table 3.2.2. Sectoral petroleum consumption (in '000 Tonnes)

Sector	1978		1983	
	'000 T	%	'000 T	%
Agriculture/Forestry	14	2	12	2
Mining	259	36	159	27
Manufacturing	57	8	58	10
Construction	22	3	23	4
Transport	200	28	265	45
Commerce	22	3	25	4
Service	65	9	23	4
Households	79	11	23	4
Total: Domestic use	718	100	588	100

Source: DOE (12)

It is very difficult to give an informative picture of how product sales prices have developed within the country, because if they are expressed solely in Kwachas, which is what the consumers experience, there are some rather unexplainable changes because of shifts between periods with politically fixed exchange rates and periods with a free exchange market. The figures listed in Table 3.2.3 must therefore be seen in relation with the changes in exchange rates listed below.

From January 79 to September 85 the consumer price index increase by approximately 240% or about 14-15% per year, which is about half of the average oil product price increase in the same period shown in Table 3.2.3. In the same period the exchange rate went from about 1 K = US\$ 1.25 to 1 K = US\$ 0.40 and in December 1986 down to 1 K = US\$ 0.15.

Due to the introduction of auctioning an average increase of about 150% in product prices was experienced from September to December 1985.

Table 3.2.3. Prices of petroleum - ex terminal

	Unit	JAN 79	SEP 85*)	DEC 85
Premium	K/m <sup>3</sup>	265	790	1975
Regular	K/m <sup>3</sup>	210	720	1800
Kerosene	K/m <sup>3</sup>	78	476	1190
Gas oil	K/m <sup>3</sup>	113	500	1250
Jet fuel	K/m <sup>3</sup>	142	700	1750
Heavy fuel oil	K/T	62	590	885
Light fuel oil	K/T	65	424	1060
LPG	K/T	105	450	1125

\*) Estimated

Source: DOE (12)

3.2.1.3. Policy priorities. The projections for petroleum consumption say that both the total level and the sectoral shares are expected to remain almost stable. The importance of conservation measures are recognized but due to the known scarcity of funds, main priority is given to basically securing a stable supply. The condition of the Tazama pipeline is deteriorating and a large rehabilitation project is planned, which is given top priority. The second part of the basic import and supply structure is the refinery and various projects are planned to improve performance here.

Energy management as a way to conservation and petroleum substitution is being promoted in the industrial sector by DOE, and it seems that there is a potential for conservation through technical changes, better maintenance, etc. Because of the general surplus of electrical power resources any substitution of petroleum products with electricity is beneficial from a national point of view and due to the fairly low electricity prices,

such substitution should also be viable from the private or parastatal company point of view depending on the size of the necessary investments for equipment and connection.

Various possibilities for substitution of petroleum products with either electricity or domestically produced coal are being considered by ZCCM (Zambia Consolidated Copper Mines), but no final decision has been taken because of decreasing international oil prices and since the coal solutions are linked to the rehabilitation of the colliery at Maamba (see Section 3.2.2).

The figures also underline the necessity of giving policy priority to conservation within transport, since it represents nearly half the total petroleum consumption. It is a sector where substitution with other fuels are difficult, ideas about producing methanol from molasses have been brought forth but have been abandoned again as a result of economical evaluations.

Expansion of transport by the railways is not a realistic present alternative, because it would require large investments in new equipment. Looking at the present state of the majority of busses, trucks and private vehicles, it seems, however, that there is great potential for conservation. But although expansion of simple maintenance would give some results, a larger effort would evidently require new spare parts or perhaps entirely new vehicles, and since these are solely imported, it is not possible in the present economic situation. The only way left to reduce consumption is therefore by increasing prices, which would inevitably have other undesirable implications on society as a whole.

The petroleum consumption in agriculture is generally low due to the low level of mechanization, and only the larger commercial farmers have an actual productive use for tractors and motorized transport. There is no real potential for savings, on the contrary the government's aim to increase agricultural production may be expected to lead to slightly higher consumption figures.



Household consumption is mainly kerosene for lighting in low income urban and rural households and to a small extent maybe also for cooking in some middle income areas. The consumption level is probably very sensitive to price changes or regulations, but since there are no realistic alternatives for lighting purposes for the low income households, increasing prices, probably only result in reduction in the number of hours with lighting. The steep decline in household consumption shown in Table 3.2.2 may therefore mainly be a result of the increasing prices illustrated in Table 3.2.3, and substitution by electricity in the high income areas.

### 3.2.2. Coal and Coke

3.2.2.1. Production and supply. In contrast to the situation for petroleum, Zambia has substantial coal deposits. Although there has been no proper assessment of the resources, it has been estimated on the basis of earlier exploration work, that reserves probably amount to about 250 mio. tonnes. There is, however, only one area being mined presently, and it is the Maamba Colliery in the Southern Province (see Fig. 3.2.1). The estimations of reserves at Maamba rank from 30 mio. to about 60 mio. tonnes of high ash coal. The mine was originally designed to produce an output of 1.2 mio. washed coal per annum (it takes about 1.5 ton of mined coal to produce 1 ton washed coal). The output has, however, never been more than 790,000 tonnes per year and since this figure was reached in the mid-seventies, the output level has been steadily declining. Several factors are responsible for this development

- the general decline in industrial and mining activities,
- reduction in demand from the mines because the refinery's process determined surplus of fuel oil was a more urgent problem and should be used instead,
- general design failures and poor maintenance.

In order to increase the production level and reduce unit costs, a series of rehabilitation projects have been performed



and others are planned with the overall aim of reaching an output level of about 700,000 tonnes per year.

Coal prices ex-Maamba are fixed by the government and have generally been lower than the actual production costs. It should be noted that Maamba Colliery is also a ZIMCO subsidiary. Compared with the oil price increases shown in Table 3.2.3, coal prices have in the period from 1979 to 85 increased by about 300%, which is above the average consumer price rise but only about half of the increase experienced for petroleum products.

Table 3.2.4. Average prices of Maamba coal (in kwacha per tonne)

1977/78	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984	1985
19.55	26.85	26.76	32.19	35.33	37.86	46.96	60.09	82.25

Source: DOE (12)

Transport from the mine to the main consumers in the Copperbelt area was planned to be by rail but due to the incapability of the railway to handle enough about half of the coal was moved by truck increasing transport costs significantly.

3.2.2.2. Coal consumption patterns. Coal consumption has, as it has just been explained, been declining from the mid-seventies to the mid-eighties, but due to some of the substitution projects in the mining sector, consumption is expected to increase significantly from 1986.

There is some divergence between the various sources of data but the general trend is clear, a large decline in the mentioned period especially in the mining sector. Since coal production has been declining even more rapidly, it has been necessary to import coal from Zimbabwe at times. There has, however, also been a small amount of export in some years, but this might be

caused by differences in the products requested by the consumer or simply that the coal production changes over time.

Table 3.2.5. Coal and Coke consumption (1978-83)

Sector	('000 tonnes)			
	1978	%	1983	%
Mining	433	62	269	51
Industry	242	34	208	40
Transport	5	1	4	1
Miscellaneous	22	3	45	8
Total	702	100	524	100

Source: DOE (12)

Note: Imported coke consumption is almost constant about 50,000 tonnes.

Within the sectors the actual number of consumers is quite small.

Mining: Main consumer is the Copperbelt Power Company.

Industry: Main consumers are Nitrogen Chemicals Factory, Chilanga Cement Factory, and Zambia Sugar Factory.

Transport: Zambia Railways is the only one.

3.2.2.3. Policy Priorities. Projections on coal consumption present a slight increase in the beginning in the mining sector but later mainly within industry. Many trends seem to contradict each other when policy priorities for all the commercial sources are considered.

The basic wish is to reduce oil imports and substitute oil products, wherever it is economical, and coal is here one possibility. It is limited, however, by the constraints on the refinery, where the product mix with a given input is fairly constant giving a surplus of fuel oil presently. But changes in

the refining process or the input type might present a possibility for changing the mix or maybe a portion of the fuel oil can be exported to some of the neighbouring countries already relying on import of refined products.

The other major constraint on expansion of coal use is the fact that Zambia has a surplus of electrical power production capacity, which will become even greater in the years to come, and as this capacity is almost totally based on the renewable source - hydropower - the marginal cost of production on existing power plants is low, and from both a financial and an economic point of view, coal is not competitive. But as economical resources during the FNDP period will be very scarce, it might be realistic to expect only fairly small changes in the overall consumption structure, apart from the declines or increases related to the level of economic activity the various sectors will be able to achieve.

So if the rehabilitation of Maamba is successful, there is no doubt that it will be able to meet even an increasing industrial demand and change a situation of small coal imports maybe to small coal exports.

### 3.2.3. Electricity

3.2.3.1. Production facilities and supply infrastructure. Zambia is today in a situation where it has a large surplus of hydropower capacity, and as shown in Table 3.2.6, this surplus situation was reached in the mid-seventies on completion of the large projects at Kafue and Kariba (see Fig. 3.2.2).

The total generation capacity in Zambia is now more than 1700 MW and about 95% of this is hydropower plants. As shown in Fig. 3.2.2 the grid is designed mainly to supply the Copperbelt area and the main town centres along the line of rail. In the Northern and Eastern provinces two isolated systems based on fairly small local hydropower stations are supplying the local and regional centers. These systems are soon going to be connected to the central system in order to stabilize supply and

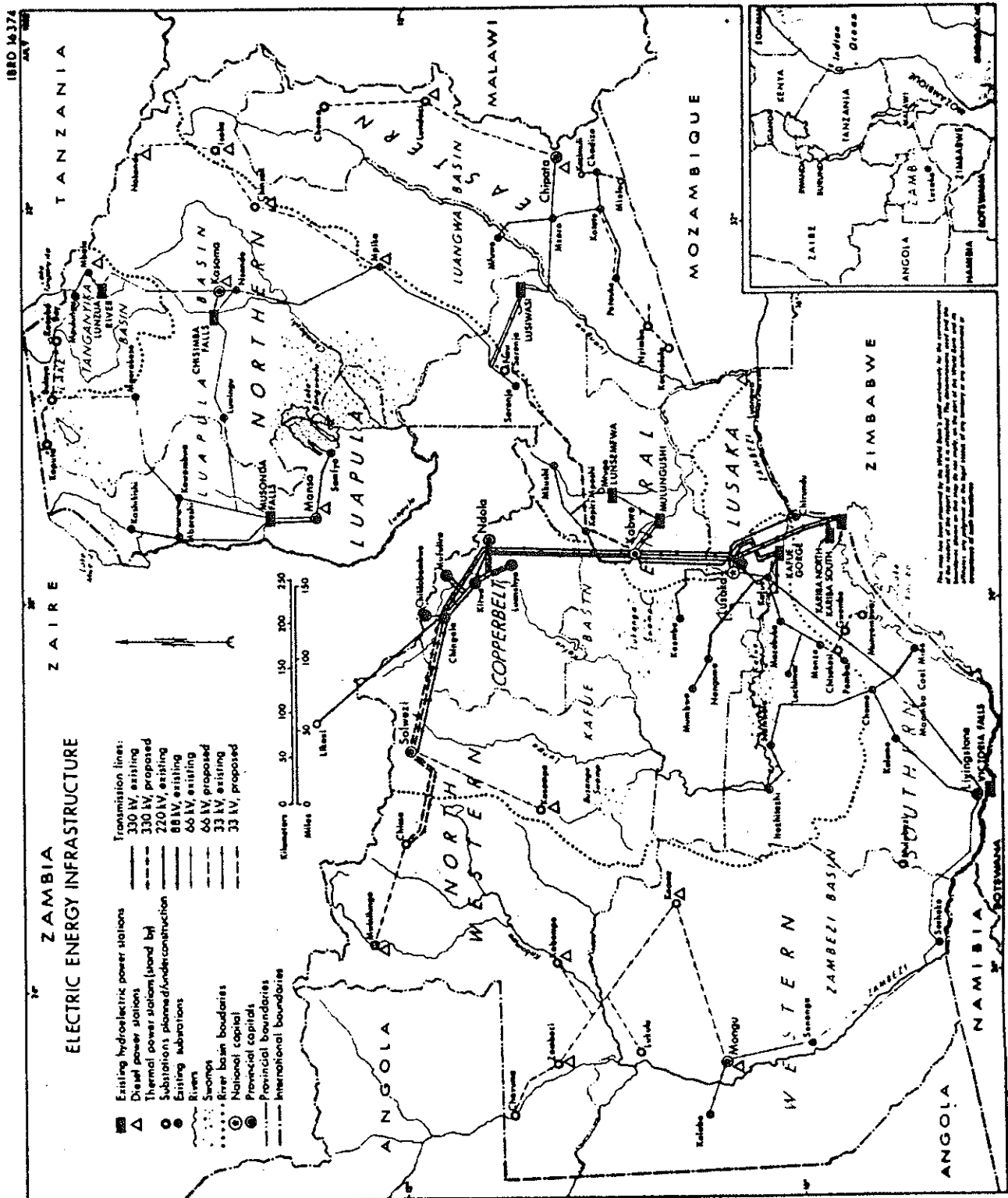


Fig. 3.2.2. Electric Energy Infrastructure - 1982

Source: UNDP/WB (25)

get a better use of the existing capacity instead of expanding the local power stations. (Interconnection at Lusiwasi is established by now.) Still only a minor part of the country is reached by the national grid and in the small district centres in Western, North-Western and part of Northern province electricity is produced locally on small diesel power stations. Interconnection of these local systems have been proposed but it is not realistic to expect the establishment of quite long and very expensive transmission lines in the near future because the demand in the rural centres is very low.

Table 3.2.6. Power plants and production - 1982/83

Power plant	Installed capacity (MW)	Generation 1982/83 (GWh)	Utilization (%)
Kafue Gorge	900	5,725	73
Kariba	600	3,807	72
Victoria Falls	100	772	88
CPC Thermal power	80	25	4
Rural Hydropower	25	84	38
Rural diesel power	5	10	23
Total	1710	10,423	70

Source: ZESCO-Power System Master Plan (28)

About 62% of the generated electricity was consumed within the country while the rest was exported to Zimbabwe.

The close cooperation between Zambia and Zimbabwe is a result of the Kariba Dam, where there are two "separate" power stations. Zambian on the north bank and Zimbabwean on the south bank, but the two countries share equally the available generated output and the related costs. The cooperation is presently institutionalized in the Central African Power Cooperation Company (CAPCO). All other electricity supply in Zambia is managed by the Zambian Electricity Supply Company (ZESCO), which is a wholly owned subsidiary of ZIMCO.

ZESCO is responsible for the remaining production and distri-

bution of electricity to domestic, commercial and industrial consumers. The last important institution in the power sector is the Copperbelt Power Company (CPC) that is responsible for distribution of electricity within the mining areas. CPC purchases electricity bulk from ZESCO, but has its own thermal stations on cold stand-by as possible back-up, if the grid supply should fail. (CPC has recently been included in the central mining company the ZCCM, and is now their Power Division.)

3.2.3.2. Electricity consumption. As in the case with the other commercial sources, the mining sector is the dominant consumer and it is even more outspoken with electricity than the other sources.

Table 3.2.7 shows the dominant role of the mining sector as electricity consumer. It also indicates the importance of CPC bulk purchases for ZESCO and because CPC's buying price is politically kept at a very low rate, it also means that some of the economical problems of the mining sector are being transferred to ZESCO. Although mining consumption has been increasing by about 1% per year the main growth has been in the manufacturing and the domestic sector. The main reasons for growth in electricity consumption at a time with declining activity in society and in the consumption of other commercial fuels are the mentioned policy activities towards using electricity as a substitute for oil products and the fact that electricity tariffs have been and are still very low compared both with other sources of energy and with prices in other countries. Until 1985 the prices of electricity rose markedly slower than the consumer price index but in late 85 there was a general increase of about 70% followed by almost a 100% increase in August 86. These increases are mainly results of the depreciation of the kwacha and its impact on loan payments, cost of spare parts, domestic inflation etc.

Tables 3.2.6 and 3.2.7 indicate (note that they do not show exactly the same time periods) that the amount exported per year



is approximately 3,500 GWh, and it is almost entirely going to Zimbabwe from the Kariba plant.

The access to electricity is, as can be seen from Fig. 3.2.2, restricted to mainly urban areas throughout the country and some parts of the rural areas in the line of rail provinces (Central (+ Lusaka), Copperbelt and Southern).

Table 3.2.7. Sectoral electricity consumption

Sector	1978		1983	
	(GWh)	%	(GWh)	%
Agriculture/Forestry	146	3	122	2
Mining	4,411	78	4,657	72
Manufacturing	235	4	485	8
Construction	20	-	7	-
Commerce	147	3	201	3
Services	246	4	282	4
Domestic	430	8	678	11
Total	5,635	100	6,432	100

Source: DOE (12)

Table 3.2.8. Households with electricity supply

Province	1969		1980	
	Number	% of Households	Number	% of Households
Central (+ Lusaka)	25,666	23.6	55,383	29.4
Copperbelt	66,820	61.4	83,701	44.5
Eastern	989	0.9	2,884	1.4
Luapula	1,360	1.3	3,777	2.0
Northern	2,761	2.5	9,880	5.1
North-Western	459	0.4	4,078	2.2
Southern	9,924	9.1	24,847	13.2
Western	807	0.7	4,099	2.2
ZAMBIA	108,786	99.9	188,229	100.0

Source: Chidumayo (9)

# INCREASE OF ELECTRICITY TARIFFS

## MAXIMUM DEMAND TARIFF D

Tariff D1 — Maximum Demand less than 300 kVA:	Fixed monthly charge: 70.00 Kwacha M.D. Charge per kVA per month 11.87 Kwacha Unit charge: 6.30 Ngwee
Tariff D2 — Maximum Demand from 300 to 2000kVA:	Fixed monthly charge: 1,325.00 Kwacha M.D. charge per kVA per month 10.82 Kwacha Unit charge: 4.10 Ngwee
Tariff D3 — Maximum Demand over 2000 kVA:	Fixed monthly charge: 13,250.00 Kwacha M.D. charge per kVA per month 9.08 Kwacha Unit charge: 2.70 Ngwee

SURCHARGES ON ISOLATED NETWORKS: Tariffs E3, E4, and D will attract surcharges as follows:

- (a) The 20% surcharge on isolated networks fed from hydroelectric sources remains unchanged.
- (b) The 150% surcharge on isolated networks fed from diesel power stations remains unchanged.

### SECURITY DEPOSITS:

- (a) Restricted supply (maximum 5 Amperes) 30.00 Kwacha
- (b) Restricted supply (over 5 Amperes) 50.00 Kwacha
- (c) Unrestricted Domestic 200.00 Kwacha
- (d) Other consumers (excluding (M.D. consumers) 500.00 Kwacha

RECONNECTION CHARGE: 85.00 Kwacha

GOVERNMENT SALES TAX: 15 Per cent

Existing consumers will be unaffected by the new deposit rates. However, in the event of a default to settle bills resulting in a disconnection, charge on the load or shift from one premise to another, the new rates shall apply.

A.G. Miti  
GENERAL MANAGER

In accordance with Section 12 of the Electricity Act, Chapter 811 of the Laws of Zambia, notice is hereby given that Electricity Billie commencing from the month of August 1986 will be computed on the basis of fixed, maximum demand and energy charges as given below. The bills based on the new charges should therefore be received by consumers in November/December 1986.

## ENERGY TARIFF L AND E

TARIFF — L	A	B	C	D	E	F	G	H	I	J	K	L
Load Limiter Rating: Amperes	1	1.5	2	2.5	3	5	6	7	7.5	10	12.5	15
Monthly Charges — Kwacha	4.6	5.4	6.3	6.5	7.11	114.8	16.1	17.5	21.7	25.9	28.4	

Tariff E1 — Restricted to 5 Amperes single phase:

Fixed monthly charge: 2.50 Kwacha  
Unit charge: 7.00 Ngwee

Tariff E2 — Restricted to 15 Amperes single phase:

Fixed monthly charge: 4.90 Kwacha  
Unit charge: 7.00 Ngwee

Tariff E3 — Domestic Only: Unrestricted single phase and up to 15 kVA three phase.

Fixed monthly charge: 18.00 Kwacha  
Unit charge: 7.00 Ngwee

Tariff E4 — Commercial Only: Unrestricted single phase and up to 15 kVA three phase.

Fixed monthly charge: 55.00 Kwacha  
Unit charge: 7.00 Ngwee

Fig. 3.2.3. Electricity tariffs (monthly rates)  
November 1986

Only about a quarter of the electrified households were rural in 1980 and about three-quarters of these rural households were situated in the three line of rail provinces and consisted of commercial farmers to a very large extent. Although the number of townships electrified in the other provinces had increased about 87% of all electrified households were still found in these three provinces, while the population here only presented 43% of the total population.

All in all the electrified households constitute only about 15% of the total number of households in the country, and it would have been interesting if data regarding the correlations between the households' income level and electricity consumption were available, because the results from the Zambezi survey (10) clearly indicated that it was only the wealthy households that could afford to use this "cheap" energy source. This is due to the fact that installation costs were prohibitive for the majority of households, and for the ones that could afford a low load unit connection, the prices of electric equipment such as hot plates, stoves, refrigerators were so far beyond their means that in practice only a few light bulbs were affordable. Although the majority of the households that have electricity installed is situated in the wealthier parts of the urban areas, it is expected that less than half of the households actually use the electricity for cooking purposes.

3.2.3.3. Policy options. Projections for electricity consumption are based on the Power System Master Plan carried out for ZESCO in 1984-85, but modified by DOE due to more recent and specific information from larger consumers, and the fact that thermal generation capacity in Zimbabwe is expected to start production in 1987/88, probably resulting in a significant decrease in the Zambian electricity export.

Consumption in the mining sector is expected to remain almost constant as a result of the combination of declining activity and conversion of various processes from oil to electricity. All other sectors are expected to increase their consumption

through the FNDP period. This projection like all other projections for the commercial energy sources is very dependent on e.g. domestic and international economic development, pricing policy or other active measures from the government aiming at conservation or substitution. Considering the present economical situation in Zambia, it seems a bit optimistic to expect an annual increase in industrial consumption of about 8% and for households the number is about 6%. If it was possible to maintain the very low electricity prices these projections might be acceptable. But considering ZESCO's present situation with a large need for costly maintenance and rehabilitation of the supply system, decreasing export earnings, etc., it is more realistic to expect increased tariffs. In fact already today revenue is below costs. It is, however, a very difficult decision to make since it is a fact that there is a surplus power production capacity, where the marginal costs of production is quite low.

Table 3.2.9. Electricity consumption projection

Sector	1984		1990	
	GWh	%	GWh	%
Agriculture	119	1.9	167	2.4
Mining	4,546	72.2	4,546	65.3
Industry	490	7.8	780	11.2
Commerce/Public	438	7.0	535	7.7
Households	583	9.2	804	11.5
Others	118	1.9	133	1.9
Total domestic use	6,294	100	6,965	100
Exports	3,109		300	
Total: Produced in Zambia*	9,403		7,265	

\* Excl. distribution losses

Source: DOE (12)

### 3.3. Woodfuels

#### 3.3.1. Charcoal

3.3.1.1. Consumption patterns. Charcoal is predominantly the fuel used by the poorer part of the urban population living in the peri-urban areas (compounds) of Lusaka and the larger cities in the Copperbelt area. In smaller rural townships charcoal is also becoming increasingly important (see Vol. 1 - Energy Survey in Zambezi).

There is also an industrial charcoal demand especially in the copper industry, but it is low compared to the household consumption.

It is, however, very difficult to find precise figures for charcoal consumption due to the fact that very few surveys have been performed. This goes for all production and consumption of woodfuels.

Estimates by Chidumayo (9) based on data from the latest population census in 1980 illustrates the consumption structure for households.

Table 3.3.1. Relative use of different energy sources in the household sector, 1980

	<u>Rural Areas</u>	<u>Small Urban</u>	<u>Large Urban Areas</u>
Total	59 TJ	6 TJ	15 TJ
Electricity	0.25%	4.1%	1.2%
Kerosene	0.9 %	4.0%	2.4%
Charcoal	1.4 %	63.7%	89.25%
Firewood	97.5 %	28.2%	7.2%

Source: Chidumayo (9)

It is evident, as also shown in Tables 3.1.1 and 3.1.2, that woodfuels are by far the dominant sources of energy for households, and Table 3.3.1 shows the connection between urbanisation and charcoal use.

This dominance of woodfuels could indicate that the consumption structure is fairly simple, but to understand the figures, it is necessary to look at the consumption at end-use level. Woodfuels are almost entirely used for cooking and water heating purposes, while as much as 88% of all households use kerosene either for lighting or to light the charcoal (not necessarily every day but sometimes). A small number of households also use kerosene for cooking, but it is usually too expensive compared to even charcoal. As shown in table 3.2.7 about 15% of all households are electrified, and there is a distinct connection between raising household income level and electricity use especially use for cooking purposes.

Looking in more detail at the woodfuel uses, it becomes clear that it is very common to use both charcoal and firewood in the transition areas between the "really" rural and "really" urban situation, where firewood respectively charcoal is the dominant fuel. The direct explanation is naturally that firewood consumption is related to its accessibility and charcoal to its price, but there are several other factors of importance e.g. income level, field work frequency, cooking habits, prestige, wood collection time etc.

Chidumayo's figures for 1980 shown in Fig. 3.1.2 add up to an annual charcoal consumption of about 368 mill. kg in the household sector alone and the copper industries consume 4-6 mill. kg a year. Small scale rural industry and service institutions also use woodfuels but although they are purchasing, it will usually be as firewood, depending on the local resource situation.

With the traditional production method this charcoal consumption is equivalent to about 4.5 mill. cu.m of wood compared to the direct firewood consumption that Chidumayo estimates to about 9.6 mill. cu.m.

These figures being from 1980 will today in general have increased and due to the rural to urban migration (population growth is about five times higher in urban areas than in rural) the main increase will be in charcoal consumption. If the population growth rate could be projected directly to energy consumption, the increase would have been more than 50%. But because woodfuels are mainly used for cooking, the relation is not that simple. Cooking for an additional family member at the same time does not require much extra fuel, so although the total consumption will increase when the population grows, it will not be proportional, and the per capita consumption will probably fall, but this hypothesis, although generally accepted, has not been studied in detail.

Just to illustrate data inconsistencies between the various sources, it can be mentioned that the UNDP/World Bank (25) on the basis of very simple per capita consumption figures estimate the total woodfuel consumption to about 7 mill. cu.m. This illustrates that while commercial energy consumption is fairly well known, woodfuels may represent from 45 to 58% of the total consumption according to these two estimates. This range seems to be much too broad and must gradually be narrowed through more comprehensive data collection in order to be able to make precise policy actions.

3.3.1.2. Production methods and distribution systems. Charcoal is all over Zambia produced using the traditional earth kiln method. The actual size and shape of the kiln may vary considerably, but the basic design is the same.

The wood used for charcoal production is mainly trees felled and logged into manageable sizes (1-2 m), which are then left to air dry, before they are ready to use. The logs are stacked into a clamp by hand just in the clearing that is a result of the felling, in this way transport of the wood before the carbonization process is minimized. The clamp is covered with earth except for a small fire-hole, where the kiln is lighted. Carbonization may take from a few days up to several weeks,

depending on the size of the kiln. The efficiency of a traditional kiln is usually regarded as very low, and the expected production is about 1 kg of charcoal per 8 kg of wood but with an energy content of about 30 GJ/t which is about double that of wood.

The efficiency is, however, closely connected to the skills of the charcoal burner, because in order to be efficient the kiln must be repaired and maintained during the process.

When the process is terminated, the finished charcoal is dug out and put into bags, usually old maize bags, and the average type takes about 30-35 kg, but there are also both larger and smaller types.

Just as with the consumption level it is not possible to give precise figures for the number of people involved in charcoal burning in Zambia. In principle charcoal producers should be licensed by the Forestry Department, and they should pay a small fee per cu.m., but in practice only a part of the charcoal is produced by licensed burners. This situation combined with lack of knowledge about what a full-time charcoal burner can produce, and the fact that many rural families are engaged part-time in charcoal production to supplement their income, makes it realistic to believe that the total number of people connected to charcoal supply in one way or another is around two hundred thousand. Even if the number is very uncertain, it indicates the big influence on the society.

The trade is mostly organized on an individual basis, but a number of official and unofficial organizations exist, but because of the "illegal" nature of much charcoal burning, it is difficult to get information.

Transportation to the markets is especially for the big urban centers an important activity.

The most common ways of transport are on bicycle, ox-cart or on old vehicles/lorries, depending on how the trade is organized and probably also to a great extent on the distance the bags have to be transported. In Lusaka motor vehicle is the most common, but according to Chidumayo (8) even here bicycle and ox-cart are of importance. This importance naturally increases when market and travel distance decreases and in the smaller



townships like Zambezi, motor vehicles are not used at all. This transport is only the part from the roadside to the market, and the task of transport from production site to the roadside has not been included.

Charcoal is sold at the the local market either as whole bags or in small lots of perhaps a few kg covering the needs for a family for just one day.

There is an official government price of charcoal but control possibilities are limited and actual selling prices are normally higher. Especially in Lusaka and the larger towns in the Copperbelt Province, prices have been raissing rapidly in the last years, e.g. from about 2-4 kwacha per bag around 1980 to from 10 to 15 kwacha in 1985. Inflation is included in prices, but prices have generally grown faster than inflation and are becoming a bigger and bigger problem for the general low-income charcoal consumer. Usually the prices paid per kg are much higher, when the charcoal is bought in the small lots, meaning that people who cannot afford to buy a whole bag end up paying more than the wealthier families. The mentioned prices are all full bag prices. The price per kg may be from two to five times higher for the small amounts.

The way charcoal is utilized is, however, almost the same all over the country. Families use a small stove made out of scrap metal, it may vary in size and perhaps also in design, but basically it is very open, and the pot is put directly on top of the charcoal. Estimates of efficiency for the charcoal stove say that it is very low, and even if there also here are variations according to the user's skill, the direct utilization in the cooking process of the energy content of the charcoal will usually not exceed 20%.

3.3.1.3. Environmental impact and policy options. The direct ecological impact of charcoal production is naturally that a forest- or woodland area is cleared, and because trees usually are considered a "free" commodity, there is no tradition nor business incentive for planting new ones. This deforestation ef-

fect has not been assessed in detail yet, but for the country as a whole the impact of charcoal production on the overall wood reserves has until now been quite modest. This does not, however, mean that local consequences have not been serious. Especially in the Copperbelt area, Lusaka and the Central Provinces, where the majority of all charcoal is produced, the impact is seen as direct deforestation at a rate estimated by Chidumayo (8) to be about 24,000 ha p.a.

The most direct consequence of this deforestation is that the distance between production and consumption of charcoal increases, which results in the rising prices on the urban market. This tendency is strengthened by the rapidly growing urban population. There are many possible derivative effects of the rising prices, e.g. poor households may buy less charcoal than what is actually necessary resulting in malnutrition, diseases from water that is not boiled etc. This part of the problem is probably the most urgent, but the long term consequences of the increasing local deforestation may also be very serious. An example mentioned by Chidumayo is that deforestation in the Copperbelt apparently has contributed to an average increase of 50% in water yield on the upper Kafue River through increased run-off, which may lead to problems with fertility of the land.

As will be discussed in the next section in relation to rural fuelwood consumption, the connection between woodfuel consumption and deforestation cannot be looked at in isolation, but must be seen together with the traditional agricultural production methods, wood use for building material and industrial purposes etc.

The problems of charcoal consumption are only gradually being recognized by the government, and it is first in the work for the now postponed Fourth National Development Plan (FNDP), that the problem of urban household energy supply is being taken into separate consideration.

Basically there are three supplementary ways of trying to address the charcoal problems

- enhancement of the efficiency of production and utilization of charcoal
- afforestation
- substitution of wood based fuels with other fuels.

More efficient stoves and kilns are being developed, but are still at a research stage, and the problem of dissemination has still to be solved. Field tests show encouraging results, and there is no doubt that more efficient stoves and kilns are an important part of a mid-term strategy to meet urban households' energy needs. The maximum level of saving seems to be around 25% and strongly depending on the skills of the user, so better stoves can mainly be seen as a temporary solution.

Afforestation is an activity of general importance from an ecological point of view, but the methods used must be carefully adjusted to the specific problems behind the deforestation. Around the large cities where charcoal production has been one of the major reasons for deforestation, it might be an appropriate solution to establish direct woodfuel plantations. In rural areas with local deforestation problems not caused by charcoal production, the solution will most likely be different, e.g. agroforestry integrating agricultural and forestry development.

The possibility of substitution of charcoal with either electricity, kerosene or perhaps briquettes is also interesting although there are several problems to be looked at. Briquettes either from coal or agricultural residues are, even if it is possible to produce them and burn them in the stoves, only a limited solution, when the magnitude of charcoal consumption is considered, but it may be a relevant possibility on a local basis. Kerosene being quite expensive and imported is not viable as a solution from a national point of view. This leaves electrification as the only major possibility for substitution, and as described earlier there is surplus of power production capacity, but there are many barriers preventing it from being a possible solution. Although the direct costs of using electricity for cooking etc. would (with the present prices) be

significantly lower than for charcoal, the initial costs of installation and the necessary equipment including hot plates, pots etc. are absolutely prohibitive. Safety regulation would be very difficult to fulfil in the low cost houses in the compounds, and the distribution networks are presently only established in high cost areas. So substitution with electricity is probably only a long term possibility, unless new ways of supply and financing could be established.

All these three ways to address the mainly urban energy problems seem to be medium and long term solutions so that little change is to be expected on the short term. All the discussed solutions aim at providing alternative and cheaper energy, another at least imaginary possibility would naturally be to raise the income of the charcoal consuming groups, because the problems related to charcoal consumption are basically a reflection of poverty in the society, and if this basic problem could be eradicated, the "surface" problems would vanish.

### 3.3.2. Fuelwood

3.3.2.1. Consumption patterns. Fuelwood is in the rural areas just as dominant a household fuel as charcoal is in the urban areas, and as shown in Table 3.3.1 fuelwood represents up to 97% of all household energy consumption in the rural areas, if the townships are excluded. The vast majority of fuelwood consumption is therefore in the household sector, although the mining industry, the commercial farms and the small scale rural industries are to a more limited extent fuelwood consumers, e.g. our Zambezi survey showed that boarding/secondary schools, hospitals etc. purchased fuelwood for cooking purposes.

As mentioned in the previous paragraph it is not possible to give precise figures for fuelwood consumption, but estimations range from 1 to 2,5 cu.m per capita a year leading to a total annual consumption between 5 and 10 mill. cu.m. Chidumayo's estimation mentioned earlier was 9,6 mio. cu.m.

The traditional rural household uses an open three stone fireplace for cooking and water heating. The pot is placed on the stones after lighting the wood, and additional wood is pushed in between the stones during the cooking process. Usually, cooking is done two or three times a day, but this varies according to tradition, food type, season etc. The energy efficiency for the direct cooking purpose is very low ( $< 10\%$ ), but the other effects of the fireplace must not be neglected, for example it provides light, heat, keeps flying insects away etc., and the social aspect of the fireplace as a site to gather around is also important. From a narrow energy point of view this might seem rather irrelevant, but in substitution and efficiency discussions, it is crucial to recognize all aspects of the present technology.

Woodfuel is in rural areas generally collected and not purchased. It is usually a job performed by the women and children of the household, and it is normal to collect wood at least 2 to 3 times a week, depending on a number of factors like family size, collection time, field work etc. In the rural townships and the surroundings of large towns where fuelwood still plays a noticeable role, supply is usually based on a mixture of collection and purchase depending on the accessibility of the "free" collectable wood. As already mentioned there is some industrial and agricultural use, and it is predominantly purchased also. The experience from the Zambezi survey showed that larger fuelwood consumers either hired people directly to be responsible for the supply or had agreements with a small number of suppliers. In both cases wood supply was mainly larger logs from trees that had been felled for the specific purpose.

Whether or not this is generally true is unknown, but it seems likely that large commercial purchases will result in organised and systematical cutting.

The household consumption is in contrast to this almost entirely collected, and it consists mostly of "dead" wood and perhaps some twigs. This also means in addition to the time it takes to walk from the house to the collection area, it may take considerable time to gather the necessary bundle of wood.

The size of the bundle is limited to what can be carried on top of the head (a "head load").

3.3.2.2. Resource situation. The Forestry Department is presently engaged in a woodfuel resource survey but final results have not been published yet. Preliminary findings and earlier surveys estimate that about 60 million ha have some kind of woodland vegetation ranking from closed forest areas to open bushland with scattered trees. This figure which equals about 80% of the total land area is regarded by many sources as being too high, and a more likely figure is probably somewhere between 40 and 50 million ha. Still in relation to the population depending on fuelwood as their main source of energy, the resource in general is sufficient, and unlike the situation with urban charcoal supply, there is no evidence of general fuelwood shortages. However, when the situation is studied in more detail there might well be local supply problems, either as a result of a locally higher population density or because the soil in the region is relatively unfertile and regenerates slowly. It is also logical that the resource of a wooded area is only interesting as a fuel source if it is accessible, and keeping the traditional mode of transportation in mind - carrying on the head - this sets narrow limits on what is accessible from a villager's point of view.

It is important, when looking at the resource situation, to bear in mind that the traditional rural fuelwood supply is not based on felling trees, but on collection of "dead" wood and branches, implying that in a situation in balance this will have no deforestation effect.

There are, however, other activities in and around the rural society that may bring the stable situation out of balance. The traditional chitemene agricultural systems are based on clearing of woodland areas, burning the trees and using the ashes as fertilizer. The area is then cultivated for 5-6 years until the nutrients in the soil have been utilized, and the area is then left to regenerate while the family starts cultivating another area. As long as population density is low, this system can

function without creating ecological problems, but when the population density reaches a level where people have to start reusing the areas which have not fully regenerated or have to expand the area where they have been moving around, then the situation slowly gets to be unstable and one of the results will gradually be deforestation. In this situation fuelwood consumption naturally contributes to accelerate the process, but it will generally not be the cause of it.

Forest and woodland areas are naturally also deliberately cleared for other reasons. The impact of charcoal consumption has been discussed already, but also clearing for commercial farming and cutting for commercial wood use such as timber, paper etc. may be the causes of local deforestation.

3.3.2.3. Policy options. As described above the present wood resource situation and the rural consumption patterns do not call for immediate action for e.g. more fuel-efficient stoves etc. Even in the areas with local shortages any technical solutions trying to solve the limited "energy problem" alone will probably fail. Because, as has already been mentioned, the shortage is a result of a combination of problems, and they can usually not be addressed individually but through integrated action. It is also very difficult to introduce a new technology in a rural society with an almost non-monetarized economy, especially if the technology is not being introduced to meet an already felt need. In any case, cooking and fuel supply is usually the women's job, so the male head of the household, who is most commonly the decision maker on investments, is unlikely to experience the "problem" directly.

Furthermore, it will be only a superficial problem to try to solve, because basically any energy problem will be only a part of a much more basic problem of development. The relevant policy questions are therefore more likely to be how development of energy supply and utilization may contribute to integrated rural development. It is naturally not possible to give any general recipe for how this shall be done, but the principles must be:

- to be aware of a planned project's possible impact on the existing consumption and supply structures.
- to plan for the energy aspects of a project or arising as a result of a project in a both an economical and environmentally adequate way.
- to identify specific areas or tasks where development and introduction of new energy supply or utilization techniques can contribute to rural development.

The term project should here be perceived in its broadest sense e.g. a programme including several interrelated activities. This is important, because the traditional narrow perception of projects as basically independent activities is counteractive to the thought of integrated development.

In order to illustrate the way of thinking a few examples will be outlined.

Agricultural development is as described in paragraph 2.3, an absolute necessity for the improvement of the general living conditions and the achievement of a higher level of self-sufficiency at the national level. Clearing of wooded areas will, however, often lead to local deforestation with consequences for other parts of the society, but if the agricultural development is planned in a balanced way, combining agriculture and forestry in, for example what is called agroforestry systems, the negative impact may be avoided.

Examples of specific tasks where new techniques may be relevant can be crop drying, milling, water pumping, where for example wind and solar systems may offer interesting possibilities. These are, however, still at a research stage in Zambia, and experience with local cooperation and production is necessary in the future dissemination process.

Rural electrification has traditionally been regarded as an initiator of development, but in general this is not true due to the same reasons that were discussed in relation to peri-urban electrification. Usually electrification has been limited to larger townships, and at least our experience from Zambezi



indicates that availability of electricity does not in itself promote any local development. This does not mean that electricity supply is not relevant in rural areas, but it just underlines the fact that also the introduction of electricity must be seen as part of integrated development or aim at a specific set of tasks.

#### 3.4. Other biomass and renewable sources

The dominant biomass and renewable energy sources, woodfuels, and hydropower together representing probably over 80% of all energy consumed in Zambia, have been dealt with in detail, but other sources might be of potential interest either locally now or on a longer term.

Agricultural residues may provide some potential but they have never been examined in detail.

In the rural context with small scale, low productive farming methods, the resource cannot be expected to have any importance, unless wood becomes very scarce. After the harvest season maize husks may occasionally be used as a supplement, but they are not regarded as a good fuel source. In connection with commercial agriculture and larger plantations the potential will be bigger, and although the vast majority is not being utilized, there are examples, for instance in the sugar industry, where bagasse is being used in boilers for process steam production, and the use of other parts of the surplus molasses has even been considered for ethanol production.

Sawdust at the larger sawmills is interesting for briquetting. At this moment the sawdust is not used for anything, and some research will be necessary to investigate the possibility of making briquettes for use in households as a substitute for charcoal. If this is not viable, maybe the resource can be used in industrial boilers, depending on the actual amount available and the costs compared with substituted fuels. Because the resource is fairly limited, briquettes of this kind will only be interesting as local alternatives.

Biogas is presently being tested at a few places as part of a research programme, but as the vast majority of cattle are grazed on large open land areas, which makes gathering of the dung almost impossible, the potential of biogas will be limited to larger commercial farms or piggeries.

There are, however, reports from Western Province about cow dung being used directly as fuel, but this is mainly a result of the scarcity of trees on the Zambezi floodplains.

Solar radiation is naturally being used passively in many traditional ways, but due to the large number of sunshine hours and the high global radiation a year, there are very good conditions for utilizing it more directly in solar water heaters, solar dryers and for special electricity demands in remote places also with photovoltaic cells. Various models of water heaters and dryers are being tested at UNZA, but some work remains to be done before local production is possible, and although the potential benefits from using solar water heaters and dryers are great, policy initiatives and an active dissemination strategy will be essential.

Wind is on a national scale not a source of any interest for electricity production, due to the generally low mean windspeeds with modest variations all over the country. Wind does, however, have a local potential for water pumping. The Technology Development and Advisory Unit (TDAU) at UNZA is working with development and testing of various designs, and demonstration projects are planned. Better assessment of the wind potential is also necessary, especially with regard to the daily and seasonal variations which are of importance for the utilization by windpumps.

#### 4. POLITICAL AND INSTITUTIONAL STRUCTURES

##### 4.1. Historical and political background

In order to understand the present situation better, where the political and administrative structures in Zambia are very closely connected, it is necessary to look at some of the historical background. The following description attempts to highlight only a few of the most important events. (More comprehensive descriptions can be found in litt. (21) + (22).)

Most of the basic structural problems that were described in the introduction have their roots in the colonial period starting in the late nineteenth century with the occupation by the British South African Company and continuing from 1924 formally under the British Colonial Office.

The creation of the Central African Federation consisting of Southern Rhodesia (Zimbabwe), Northern Rhodesia (Zambia), and Nyasaland (Malawi) did not bring about much change, Zambia was still the weak part mainly being exploited by the white interests of Southern Rhodesia, development was still centered around copper mining and the commercial farmers along the line of rail and no Zambians were allowed into skilled positions. The first struggle for independence began around the creation of the Federation. Political organisations were not allowed, but as a result of pressure from especially the African mine workers, a number of welfare societies had been formed during the late forties, and in 1948 the Federation of Welfare Societies was changed to the first really political organisation the Northern Rhodesia Congress, which was later renamed the African National Congress (ANC). ANC tried to stop the creation of the Central African Federation but did not succeed, and their influence was gradually reduced. A number of more militant people broke out of the ANC in 1958, and after a period of political persecution, the new United National Independence Party (UNIP) was formed with Kenneth Kaunda as its leader.

After a fairly short period of struggle, at least compared to many other African countries, independence was reached officially in 1964, where the first elections based on "one man one vote" were held.

UNIP won 55 out of 75 seats in the new National Assembly while the remaining seats were divided between 10 reserved for white representation and 10 won by ANC. The result was naturally a UNIP Government headed by a President: Kaunda.

The administrative system that the new government inherited was basically very weak especially concerning policy planning, economic planning etc. because many of these activities had been undertaken from Southern Rhodesia or the Republic of South Africa (RSA). The role of the colonial administration was mainly control and suppression and not development. Higher level staff both in administration, parastatals and in the mining sector was solely white, mainly expatriate (non-Zambian people on short term contract). The first staff training centre was just established in 1963, and combined with the fact that both the colonial rule and the federation had suppressed any higher education in the country, the number of African Zambians with a higher education was only around a hundred and none at all with a technical education. The few Zambians with higher education had mainly received it in Southern Rhodesia or RSA.

These weaknesses together with a natural political wish to Zambianize institutions as quickly as possible lead to a situation, where both the new political leaders and their administrative organisation were very inexperienced. Furthermore, the political system was very fragile, as the nation consisted of a large number of different cultures/tribes with their own languages and naturally competing about political influence in order to share the limited economical resources.

In this situation the president became the symbol of unity, and the dominant political power was concentrated in the President's Office, where Kaunda created a corps of advisers and assistants. The formulation of the formal political ideology "Humanism" was also the work of Kaunda, combining ideas of nationalism,

socialism and traditional African ideas in a one party state with participatory democracy. The goal was that the one party state should gradually emerge through elections, but as a result of some political unrest and tendencies towards increasing fractionalism, in 1972 Kaunda banned parties other than UNIP.

This creation of "the one party participatory democracy" constitutionalized the dominant role of UNIP, and the structure of the party has gradually been developed as a parallel to the institutional structure of state administration. Furthermore, the party representatives at a certain level will always be formally higher ranked than the government representative at the same level. The dominant role of the party is also illustrated by the fact that all decisions and announcements refer to "the party and its government". The president being leader of both government and party therefore still maintains the totally dominant power, and through the paternal role Kaunda also functions as a central person in the political process of unifying the different groups and classes.

#### 4.2. Political and administrative organisation

The parallel political and administrative structures are shown in Fig. 4.1. The level of detail in this report about sub-committees and ministries is kept low, because changes are frequent. It has become practice that the president makes reconstructions of the structure or reshuffles a number of persons in charge (ministers, permanent secretaries etc.) once or twice a year. This "search" for better organisation has naturally a disrupting effect on continuity within civil service, and also helps to strengthen the position of the president being the only really stable political force. In 1985 for example both the Prime Minister and the Secretary General of the Party were replaced at the same time. The president also has a large direct influence on the composition of the National Assembly, the Central Committee and as already mentioned the Cabinet, either by directly appointing members or through the function of having to accept possible candidates.

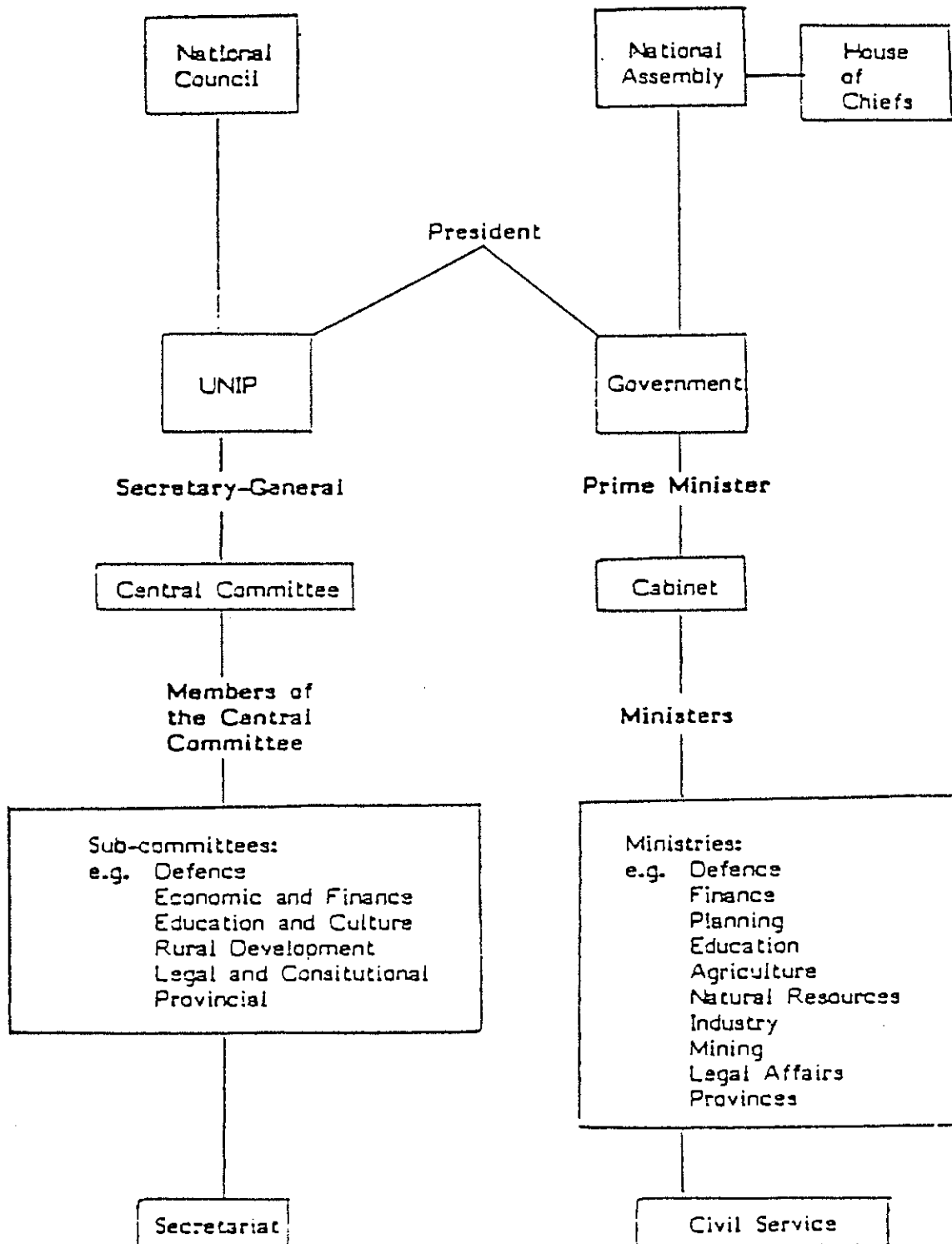


Fig. 4.1. Political and administrative structures

Source: M. Bell (3)

The structure with parallel administrative and party organisations continues also on lower levels (Provincial, District, Ward, Village), and underlines the party's political influence on all aspects of policy planning and administration.

As described in section 4.4, the influence of UNIP is not restricted to state administration, but through the large parastatal sector, the influence is spread through all parts of Zambian economy.

It is difficult to judge the impact of the close connections between party and administration, because it has been developed in a continuous process since independence and reinforced by the formation of the one party state. But some consequences are evident when you look at the structure from the sector level. For example the President's and high level party officials' influence on the promotion of specific projects, the reluctance to delegate responsibility resulting in situations where high level leaders have to decide on even very small questions. Another interesting aspect of this political system is that there are no clear links to either trade unions or employers' associations, and their influence on policy is generally low. Policy continuity should also be another logical result of this structure. Since energy institutions and energy policy planning have been established quite recently, it is not possible to evaluate this aspect in the energy sector. But in general the frequent reshufflings and the search for new ways to attack problems seem to counteract the expected continuity.

#### 4.3. National development planning

Since independence it has been the aim to base the development efforts on comprehensive development plans with 5 years planning periods. These plans should specify both general and more specific sectoral objectives that were to be pursued, give an analysis of the immediate past and present situation, the expected economic developments both nationally and internationally, the available resources for development activities, etc.

The First National Development Plan was launched in 1966 covering the period up to 1971. The second plan was not ready before 1972 and covered the period including 1976, at this time the economic recession described above had hit the Zambian economy, making any planning activity rather illusory. The consequence was that the Third National Development Plan (TNDP) was not published until 1979.

Looking at the ambitions and objectives set up in these plans and the achieved results, there are considerable differences especially regarding agricultural and rural development caused both by overambitious planning targets, lack of actual implementation will and economic problems imposed by international development. For a more comprehensive discussion of the first three national development plans and a discussion of the actual developments see ref. (16).

With the TNDP both the organisation and procedures for the planning activities were changed. A new central body the National Commission for Development Planning (NCDP) was created in administrative connection with the Ministry of Finance. The high political status of the NCDP was underlined by the fact that the President was chairman and the Prime-Minister was vice-chairman of the commission.

In order to strengthen sectoral planning and execution new planning units were to be established in the major ministries and in the provincial headquarters as a part of TNDP and annual plans should help to pursue the development plan goals.

This structure is now almost established and in connection with the preparations for the Fourth National Development Plan (FNDP) many of these ministerial planning units were used as "secretariates" for the Sectoral Development Planning Committees. The sectoral committees have together with general committees for macro-economic planning, financial resources and intersectoral linkages been the backbone of the FNDP preparations. Most of the preparatory work was finished mid-1986, but due to the present critical economic situation and the reform programme



imposed by IMF, many of the basic conditions for the already performed FNDP work have changed, and by early 1987 the plan had still not been presented.

#### 4.4. The parastatal system

Parastatal organisations and companies have existed in Zambia since before independence, the main inherited parastatal bodies were, however, of a semi- or non-commercial nature e.g. the various marketing boards for maize, cattle, dairy products. These organisations had been created by legislative acts to handle important tasks that were of national interest but not directly profitable. A number of other parastatals of the semi-commercial type has been formed since then. The transport sector is a good example of this with Zambia Railways and Zambia Airways Corporation, both being formed in the mid-sixties as results of the dissolution of Central African Federation organisations. These rather "traditional" public bodies are in principle working under commercial conditions, but due to their importance for society in general and to the country's economic situation, they are being subsidized.

The number of directly commercially working parastatals was few at independence, but this type of organisation was seen as the major political way to expand industry and trade and at the same time increase Zambian control of their own economy.

The Industrial Development Corporation (INDECO), which had been set up as an investment corporation to stimulate foreign investment in Zambia, became the central organisation in the early expansion of commercial parastatals both in areas, where there were no previous companies and through part or total purchase of large established firms of strategic importance.

The INDECO "model" was also used in 1969, when the President declared that Zambia should take over influence in the mining sector. The Mining Development Corporation (MINDECO) was formed and took over 51 per cent ownership of the mining companies, this share was in 1979 increased to about 60 per cent. The actual detailed company structures are more complicated but not

important on this level of description. In 1982 the MINDECO structure was changed and the main copper mining activities were gathered in Zambia Consolidated Copper Mines Ltd. (ZCCM). Still the main part of the original owners' technical and managerial expertise was maintained through management agreements, and the dependence on the foreign companies therefore remained high. This also shows that commercial aspects have been given high priority, although it means that the process of Zambianisation is slower.

In view of the overwhelming importance of the mining sector for society ZCCM is naturally one of the most influential parastatals, but the development of commercial parastatals has been extended to most sectors of Zambian economy.

In order to control and coordinate all these companies the Zambia Industrial and Mining Corporation (ZIMCO) was established as a sort of holding company embracing most commercial and semi-commercial parastatals. The role of ZIMCO has varied considerably over time, because reorganisation as a tool for control has also been used in the parastatal sector by President Kaunda, who is chairman of the board in ZIMCO. Until 1971 ZIMCO had central responsibility for activities within its subsidiaries and was administratively connected to a Ministry for State Participation. This centralized structure was drastically changed in 1971, the major subsectoral holding companies like INDECO and MINDECO were given more responsibility, and they were administratively connected to the sector ministry, abolishing the Ministry for State Participation and reducing ZIMCO's influence. In 1979 the structure was basically changed again and ZIMCO's policy planning and coordination role was strengthened and the connections between the Ministries and the sector cooperations were loosened.

In order to illustrate the magnitude and importance of ZIMCO, Fig. 4.2 lists the major subsidiaries and associate companies and indicates the percentage of shares held by the state. The list is from 1983 and as mentioned, changes are frequent, so there are various recent changes that have not been included (the ones of importance to the energy sector are dealt with later).

Zambia Industrial and Mining Corporation and its subsidiary companies

## MAJOR SUBSIDIARIES AND ASSOCIATE COMPANIES

1 April 1983

### AGRICULTURE AND RURAL DEVELOPMENT

RURAL DEVELOPMENT CORPORATION Ltd. 100%  
 AFE Ltd. 98%  
 The Agricultural Finance Company Ltd. 100%  
 Cattle Finance Company Ltd. 100%  
 Kawambwa Tea Company Ltd. 100%  
 Poultry Development Company Ltd. 100%  
 Rural Air Services Ltd. 100%  
 Zambia Agricultural Development Ltd. 100%  
 Zambia Pork Products Ltd. 100%  
 (Associate company)  
 Zambia Seed Company Ltd. 40%

### COMMUNICATIONS

POSTS AND TELECOMMUNICATIONS CORPORATION 100%

### ENERGY

BP Zambia Ltd. 50%  
 LUBLENCO Ltd. 60%  
 TAZAMA PIPELINES Ltd. 67%  
 ZAMBIA ELECTRICITY SUPPLY CORPORATION Ltd. 100%  
 ZAMBIA NATIONAL ENERGY Ltd. 100%  
 (Associate companies)  
 Agip Zambia Ltd. 50%  
 Inland Petroleum Refinery Company Ltd. 50%

### FINANCE

ZAMBIA NATIONAL BUILDING SOCIETY (Administered)  
 ZAMBIA NATIONAL COMMERCIAL BANK Ltd. 99.8%  
 ZAMBIA NATIONAL INSURANCE BROKERS Ltd. 90%  
 THE ZAMBIA STATE INSURANCE CORPORATION Ltd. 100%  
 Auto Cure Ltd. 75%  
 Avondale Housing Project Ltd. 100%  
 City Radio and Refrigeration (1975) Ltd. 100%

### HOTELS

NATIONAL HOTELS DEVELOPMENT CORPORATION Ltd. 100%  
 Zambia Hotel Properties Ltd. 30%

### INDUSTRIAL

INDECO Ltd. 100%  
 Anro Industries Ltd. 30%  
 Chilanga Cement Ltd. 60%  
 Consolidated Tyre Services Ltd. 100%  
 Choma Milling Company Ltd. 100%  
 Crushed Stone Sales Ltd. 100%  
 General Pharmaceuticals Ltd. 100%  
 Indeco Milling Ltd. 100%  
 Indeco Properties Ltd. 100%  
 Kabwe Industrial Fabrics Ltd. 100%  
 Kafirunda Ltd. 54%  
 Kafue Estates Ltd. 100%  
 Kafue Textiles of Zambia Ltd. 55%  
 Kapiri Glass Products Ltd. 39%  
 Livingstone Motor Assemblers Ltd. 70%  
 Luangwa Industries Ltd. 100%  
 Lusaka Engineering Company Ltd. 60%  
 Mansa Batteries Ltd. 91%  
 Metal Fabricators of Zambia Ltd. 51%  
 Zameta Sales Ltd. 51%  
 Monarch Zambia Ltd. 100%  
 Motor Parts Distributors Ltd. 100%  
 Mwaseni Properties Ltd. 100%  
 National Breweries Ltd. 51%  
 National Milling Company Ltd. 74%  
 Nitrogen Chemicals of Zambia Ltd. 100%  
 Norening Plastics Ltd. 100%  
 ROP (1975) Ltd. 100%  
 Rucom Industries Ltd. 100%  
 Supa Baking Ltd. 100%  
 Zimbezi Saw Mills (1968) Ltd. 100%

Zambia Breweries Ltd. 55%  
 Zambia Ceramics Ltd. 100%  
 Zambia Clay Industries Ltd. 100%  
 Zambia Oxygen Ltd. 51%  
 Welding Electrodes Ltd. 51%  
 Zambia Steel and Building Supplies Ltd. 100%  
 Zambia Sugar Company Ltd. 73%  
 Nakambala Estate Ltd. 78%  
 (Associate companies)  
 Duncan, Gilbey and Matheson (Z) Ltd. 40%  
 Dunlop Zambia Ltd. 23%  
 Nkwazi Manufacturing Company Ltd. 5%  
 Scaw Ltd. 27%

### MINING

MAAMBA COLLIERIES Ltd. 100%  
 METAL MARKETING CORPORATION OF ZAMBIA Ltd. 100%  
 Memaco Services Ltd. 100%  
 Reserved Minerals Corporation Ltd. 100%  
 MINOECO LUMWANA Ltd. 60%  
 MINOECO NORANDA Ltd. 51%  
 MINOECO SMALL MINES Ltd. 100%  
 MOKAMBO DEVELOPMENT COMPANY Ltd. 51%  
 ZAMBIA CONSOLIDATED COPPER MINES Ltd. 60.3%  
 Copper Industry Service Bureau Ltd. 60.3%  
 Copperbelt Power Company Ltd. 60.3%  
 Mines Air Services Ltd. 60.3%  
 Mining Timbers Ltd. 60.3%  
 Mulungushi Investments Ltd. 60.3%  
 Nehanga Farms 100%  
 Ndola Lime Company Ltd. 60.3%  
 Zam Cargo Ltd. (incorporated in England) 60.3%  
 Hyperion Properties (Jersey) Ltd. (incorporated in Jersey) 60.3%  
 RCM Drilling Company Ltd. 60.3%  
 RCM House Properties Ltd. 60.3%  
 Mpelembe Drilling Company Ltd. 60.3%  
 Mpelembe Trustees Ltd. 60.3%  
 Mpelembe Properties Ltd. 60.3%  
 Zambia Appointments Ltd. (incorporated in England) 60.3%  
 Zambia Engineering Services Ltd. 60.3%  
 RST Management Services Ltd. 60.3%  
 Sand Sales Ltd. 60.3%  
 Technical Management Services of Zambia Ltd. 60.3%  
 Re direction Placement Ltd. (incorporated in England) 60.3%  
 (Associate company)  
 Societe de Coulée Continue de Cuivre (incorporated in ) 30.15%

### REAL ESTATE

ZIMCO PROPERTIES Ltd. 100%  
 ZIMCO SERVICES Ltd. 100%

### TRADING

NATIONAL IMPORT AND EXPORT CORPORATION Ltd. 100%  
 Consumer Buying Corporation of Zambia Ltd. 100%  
 Mwaseni Stores Ltd. 100%  
 National Drug Company Ltd. 100%  
 NIEC Agencies Ltd. 51%  
 NIEC Overseas Services Zambia Ltd. 100%  
 NIEC Stores Ltd. 100%  
 Zambia Horticultural Products Ltd. 100%  
 Zambia National Wholesale and Marketing Corp. Ltd. 100%

### TRANSPORT

CONTRACT HAULAGE Ltd. 100%  
 UNITED BUS COMPANY OF ZAMBIA Ltd. 100%  
 ZAMBIA AIRWAYS CORPORATION 100%  
 National Air Charters Zambia Ltd. 100%  
 ZAMBIA RAILWAYS 100%  
 Zambia Concrete Ltd. 100%  
 (Associate company)  
 Zambia Tanzania Road Services Ltd. 35%

(Direct Subsidiaries are shown in Capital Letters)

Fig. 4.2. Major subsidiaries and associate companies

Source: SIMPSON (21)

The close connections to party and government are evident at all levels. In ZIMCO the President is chairman of the board and the other members are drawn from Government, senior management and trade unions. Government representatives in ZIMCO are of Ministerial rank, while in the subsidiary corporations senior level officers - usually Permanent Secretaries represent the sector Ministry.

This naturally provides the party and government with strong control and regulation possibilities, but the growing economic problems during the last 10 to 15 years have put severe restrictions on the possibilities for policy actions. Furthermore, the commercial status combined with the fact that many of the large corporations especially within the mining sector are owned jointly with large multinational companies further limits the freedom of action.

The strategic management of ZIMCO is in principle parallel to government planning system with five year development plans and annual status and short term plans.

ZIMCO sets the economic guidelines and the financial and physical objectives for the corporation's plans and afterwards evaluates and monitors the plans. In this way ZIMCO is at least in principle able to coordinate the individual corporations to pursue national economic development. The limitations to this have already been mentioned. The difficulty of recruiting qualified manpower in the parastatals as well as the public sector places some practical limitations on both the individual corporation's planning and reporting abilities and on ZIMCO's coordination.

## 5. ENERGY SECTOR INSTITUTIONS

### 5.1. Introduction

The fairly general description of the national political and administrative structures in the previous chapter provides the background for understanding the more in depth presentation of the institutions active in the energy sector given in this chapter.

The structure of the energy sector institutions follow the general pattern but since the interest in energy as a specific field for coordination and policy activities has emerged only within the last 10-15 years, the institutions working with energy in general are new, while the ones that deal with specific aspects like the individual energy resources are older and not always very concerned with the energy planning aspects of their work.

There are basically four types of institutions active in or related to the energy sector

- Central administration (Ministries, Departments)
- Parastatal corporations
- Advisory bodies
- Research and development institutions.

Due to the above mentioned "historical" reasons and a growing recognition of both the need to coordinate activities and the role of woodfuel as a very important contributor to national energy supply, there are certain bodies with overlapping responsibilities, but often also with a lack of coordination. The recent work with the preparation of the FNDP has, however, helped to provide better knowledge of and coordination between the institutions that have been involved in the Energy Sector Planning Committee or in one of the two sub-committees. It is

the ambition that these committees should continue also after the termination of the FNDP exercise, because they provide an important forum for addressing all energy aspects. The committees are not further described because the actual status is uncertain, but members are drawn from all four types of energy institutions and from private industry.

Regional collaboration within the SADCC (Southern African Development Coordination Conference) framework is a new activity with growing importance for national planning in the member countries, and it will be discussed briefly.

## 5.2. Central administration

There are several ministries and departments directly or indirectly involved in tasks with energy sector relevance or impact. The description here will, however, focus on the Ministry of Power, Transport and Communications (MPTC) and its Department of Energy (DOE) mainly because it is gradually becoming the central institution for energy policy and -planning and obviously also because it is the Zambian partner in this project.

### 5.2.1. Ministry of Power, Transport and Communications

The name of the ministry indicates that its traditional role within the energy sector was only related to power production. The former Electrical Engineering Department, which role was to coordinate and regulate the former independent electricity authorities, was dissolved, when ZESCO was given this task and the role of the ministry in power matters decreased. With the growing concern for energy matters especially as a result of raising oil-prices in the late seventies, the need for a special body to advise government on energy questions became evident. This led to the formation of the National Energy Council (NEC) in 1980 with the main task of advising the government on energy policy questions (see section 5.4).

Partly on recommendation from NEC the Department of Energy was established in 1982 within the MPTC. There is some disagreement about what the role and function of DOE was intended to be, but it has gradually developed in the direction of being responsible for energy policy preparation and -planning with a growing role as coordinator between all involved institutions. The central role of DOE in the energy sector was recently underlined by the fact that it functioned as secretariat for the Energy Sector Development Planning Committee in the FNDP work.

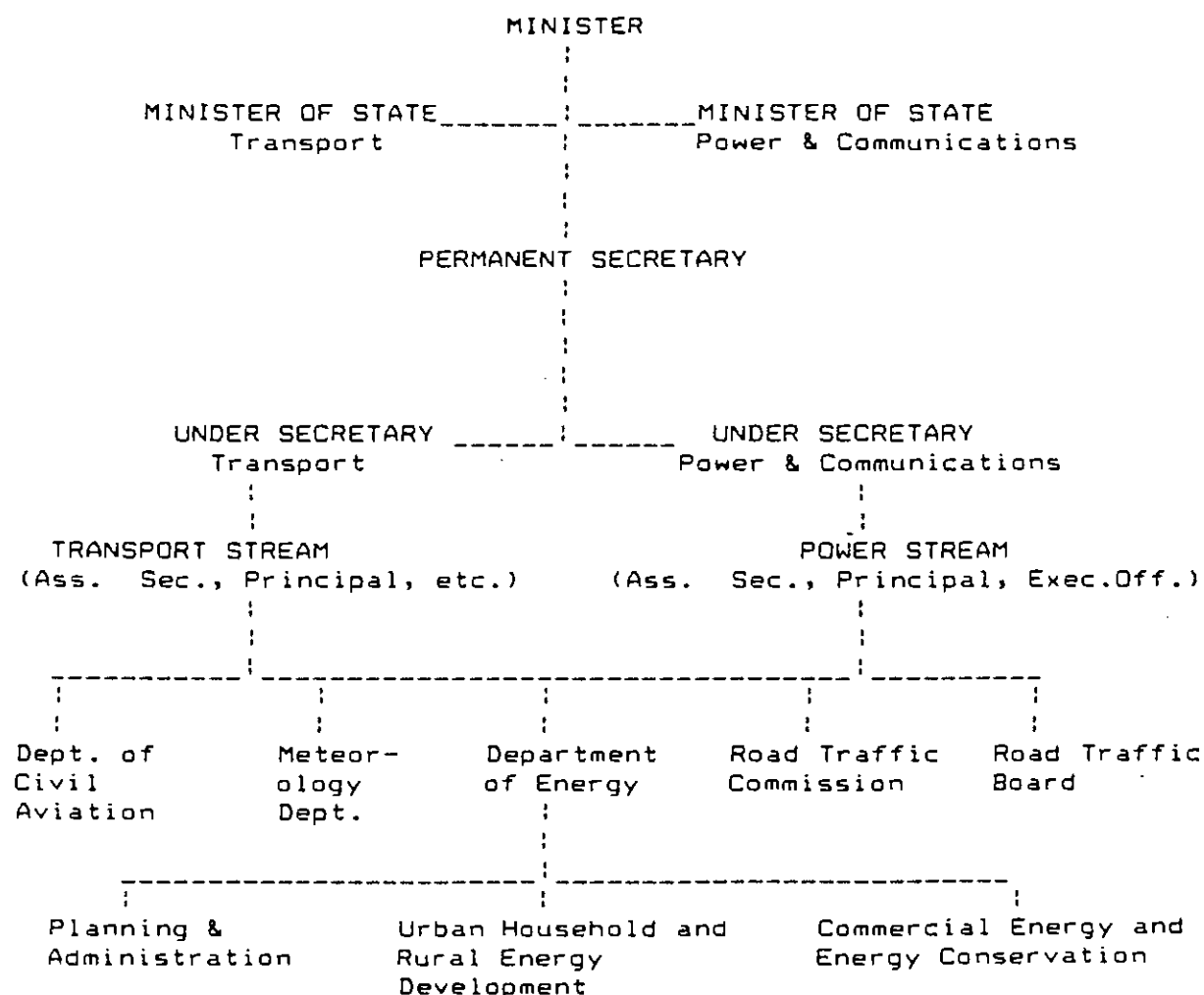


Fig. 5.1. Structure of the Ministry for Power, Transport and Communications and the Department of Energy.

After an initial starting phase the structure of the DOE was established during 1983 and 1984 with two technical sections and a broader section for planning, economy and administration. From the start the department has been dominated by the fact that the number of expatriate advisers is high in relation to the Zambian staff, which except for the Director was almost without previous professional experience at the time of recruitment.

When the number of employed was at its hitherto highest level in 1985 there were 9 Zambian professionals, 5 expatriate advisers and a supporting and secretarial group of 6. The number of expatriates has decreased to four and is expected to be reduced further to three at the end of 1987.

As a step towards Zambianisation of the department the reduction of the number of advisers is quite natural. However, because three Zambians are on leave for university studies and one has left for a better paid job, the process of reducing the number of expatriates should perhaps be more gradual than originally planned in order to maintain the central role that the DOE has achieved. Although employment conditions in the civil service are poor compared to what is achievable in private or parastatal corporations especially for university graduates, the core Zambian staff has remained almost stable for the last three years and the ones on leave expect to continue in their positions. Although this situation may change with increasing differences in employment conditions, the major present problems concerning staffing is first of all that it is very difficult to establish the necessary new posts and secondly it is difficult to get new qualified graduates.

The problems of recruitment are accentuated by the stiff and formal rules concerning formal qualifications. People who have achieved their skills outside the education system have considerable difficulty getting accepted for a position. Furthermore, it is often very difficult to be promoted without without having a postgraduate degree. A result of this is that the expatriates that were meant to be counterparts to the Zambians often have become acting "heads" of the sections. Some relaxation of the situation has occurred, both formally and in practice, but the urgent need for additional Zambian staff still



remains in order to maintain the favourable position that DOE has achieved and to continue the process of Zambianisation.

The three sections in DOE have developed quite different approaches and work methods. This is partly a result of their different types of tasks but also a consequence of the specific interests and experiences of the expatriate advisers from different countries.

The Planning and Administration Section has focused on

- establishing a reliable updated balance for mainly commercial energy sources and consumption
- developing a general energy data base/system with present and historical data
- analysis of supply/demand scenarios for commercial energy.

The task of basic data collection on commercial energy is now more or less reduced to updating the fairly comprehensive material compiled.

Data analysis has until recently been simple and performed "manually" on a personal computer. During 1986 the Less Developed Countries Energy Alternatives Planning System - LEAP was installed at DOE. LEAP is basically an accounting model where the user can generate relevant scenarios and analyse the economic and resource consequences.

The LEAP model is, however, designed with great emphasis on biomass/woodfuels, which considering the importance of these fuels is quite logical. So it presents the section with the problem of achieving reliable data about woodfuel supply and consumption. As already mentioned in chapter 3 this is quite a difficult task, as illustrated by the department's early involvement in the National Energy Survey together with NEC and the University of Zambia (UNZA) which did not result in reliable results due to both methodological weaknesses and poorly planned sampling.

Some more reliable data may become available from a project performed by Forestry Department/FAO aiming at both woodfuel con-

sumption and supply. This project was, however, not planned primarily with energy planning in mind. The section is now together with the relevant bodies preparing a more comprehensive project.

Besides the energy planning tasks the section also takes care of analysis of projects for the rural electrification programme and more general budgetary and administrative tasks.

The professional staff in the section consists of one economist, two planners, one computer assistant, and two expatriates (energy planner and economist). Of the Zambian staff two (the economist and one planner) are at present on study leave.

The Commercial Energy and Energy Conservation Section is in a situation, where responsibility for the supply of the various types of commercial energy is organized in large mainly parastatal corporations (ZESCO, Maamba, INDENI etc.), as described in detail in chapter 3. The role the section can have on the supply side is therefore mainly coordinative and monitoring, and these functions have to grow along with the recognition of DOE's position and the experience of the staff in the section, which presently consists of two Zambian engineers and one expatriate adviser.

With this structure on the supply side, the section has chosen from the start to focus especially on industrial consumption and the general possibilities for conservation and substitution of imported energy by domestic sources.

This program has among other items included

- survey of industrial energy consumption and efficiency
- identification of potential areas for energy conservation, fuel substitution etc.
- promotion of energy management and awareness through courses and discussions.

Late in 1986 the program was extended to including auditing activities in selected industries. This extension was based on a UNDP grant for both auditing equipment and a short term consultant to support the section's programme officers.

While this industrial energy conservation and management project continues, the section will start to look at the large potential for energy conservation in the transport sector, and on a more limited scale the section will take up the monitoring role in relation to internationally funded projects.

The Urban Household and Rural Energy Development Section (UHRED) started out as a section for new and renewable energy just as the Commercial Energy Section in the beginning was limited to fossil fuels, a structure that reflected the developed country way of looking at energy planning. In the present "new" structure the tasks of the sections better reflect the realities of the Zambian society, and the UHRED section is therefore especially concerned with supply and consumption of wood-fuels, but this concern naturally also leads to looking at conservation and substitution possibilities. Furthermore, it is recognized that in the rural context, there is a need for an integrated approach, where energy usually enters as a component in broader development programmes.

The situation for the UHRED section is to some extent parallel to that of the Commercial Energy Section in the way that the supply side concerning woodfuel is officially controlled by other institutions. The difference is, however, that these institutions are other Departments within the state administration, and that they have not been especially concerned with supply of wood for energy purposes.

Political recognition of the magnitude of energy consumption and related problems in urban households and rural areas is relatively recent. Activities within this field have been scarce and scattered. The FNDP is the first national development plan in which rural and household energy matters have been dealt with separately.

The UHRED section has therefore a potentially key role to play as coordinator of the involved institutions and activities as well as in the formulation of future strategies for addressing the "energy problems". In the beginning the section focused almost solely on trying to formulate a comprehensive strategy

for the work without at the same time interacting with the institutions which were already involved in the field. With the formation of two sub-committees dealing with urban household energy and rural energy for the FNDP work, this situation was changed radically and a number of specific activities and projects were planned with UHRED in a central coordinating role. These activities and project proposals are basically results of a combination of already existing programmes at the individual institutions and the formulated strategy ideas of the UHRED section. Because of the general lack of previous experiences most of the activities for the first period are studies, pilot projects, surveys, etc. aimed at gaining a better knowledge of how more substantial projects should be designed.

Within urban household energy the activities are naturally centered around charcoal and the two general possibilities for

- increasing the efficiencies of production and utilization
- substitution with other fuels.

The programme is to a great extent concerned with technical solutions but with a strong socio-economic dimension included.

The plans for a rural energy programme consist basically of two complementary activities

- gathering of information about the role of energy in the complex, interacting rural society in order to improve the integration of energy aspects in rural development efforts,
- testing of a number of renewable energy technologies utilizing respectively wind, solar, hydro and biomass resources, in order to assess their potential role in future development projects.

One of the first combinations of the two activities is a working group especially looking at rural water supply.

The FNDP work and these plans were drawn up at a time in 1985, where the section was staffed with two Zambian engineers and one expatriate adviser. Unfortunately, one of the Zambian left soon

after for a better paid job, and this was followed in mid-1986 by the departure of the adviser on the expiry of his contract, and finally the remaining Zambian went on study leave for post-graduate education in the U.K., so until late 1987 the section has no staff.

The activities performed by other institutions continue, and the planning section in the DOE tries to monitor the most important projects, but in general the future of the rather ambitious programmes and the role of the UHRED section as coordinator is most uncertain.

This development with the UHRED section illustrates the fragility of the DOE (and indeed Zambian institutions in general), and the need for strengthening of the institution, if it is supposed to be able to maintain and perhaps increase its function as the central policy planning and project coordination body.

#### 5.2.2. Other directly involved ministries

The two main ministries that have a direct involvement especially with energy supply are the Ministry of Mines and the Ministry of Lands and Natural Resources, both are well established with fairly long experience and a clear legislative basis.

The Ministry of Mines is naturally in a society dominated by mining activities of great importance, and it has clear licensing and regulatory functions within the energy sector for both coal mining presently only at Maamba Colliery and the World Bank sponsored oil exploration programme.

The Ministry of Lands and Natural Resources is divided into departments with responsibility for each their type of land area e.g. national forests, game management areas etc. The two departments with direct woodfuel energy interests are: Forestry Department (FD) responsible for national forest reserves with the traditional tasks of protection, maintenance and management, furthermore FD has for a longer period been active in small

scale plantation at the local community/district level. The FD has a fairly decentralized organisation with both provincial and district offices making it an organisation in principle well suited for small scale local activities, but until the early eighties focus was on maintaining official State forest reserves, establishing new industrial plantations, forest industries etc.

With the formation of ZAFFICO - Zambia Forestry and Forest Industries Corporation and the reorganization of the FD the non-industrial aspects including woodfuel supply started receiving more interest. A growing recognition of increasing local deforestation has also emerged during the most recent years and research concerning e.g. community - and agro-forestry, better charcoal kilns etc. has been initiated. With support from among others FAO the earlier mentioned Wood Consumption and Resource Survey was started.

A more direct involvement in woodfuel matters is the licensing system for wood cutting for energy purposes, mainly charcoal burning. The cost of the license is extremely small and is not meant as a restriction but mainly to be able to register consumption. In practice, however, only a limited part of the wood cuttings are licensed and since both the "legal" and the "illegal" cutting take place outside the national forest reserves, FD traditionally has no responsibility for replanting and management. This dilemma is gradually being recognized and management and protection of indigenous forest reserves are being taken up in relation to the activities around the FNDP preparations.

Department of Natural Resources (DNR) is officially responsible for these natural woodland areas but mainly with monitoring functions. Compared with the FD the DNR is quite a small institution, without the decentralized structure with local representatives. In spite of these facts the DNR has been quite active in research on woodfuel problems.

These activities have covered rural and urban household consumption, charcoal production and marketing, productivity of natural woodland types etc. DNR is both nationally and internationally recognized for these activities. There has been a marked difference in attitudes towards the problem of deforestation in DNR and FD, meaning that the DNR research results have seldom been used by FD as a basis for action. With the recent changes in FD this might gradually change too, and information flow and coordination of activities between the bodies involved with wood supply and consumption is actually improving.

Other sector ministries have naturally a certain amount of influence on energy consumption within their sectors e.g. industry, agriculture, both through sector policy and through influence on the sector parastatals. The special role of the NCDP with official responsibility for policy coordination has been described earlier and will be taken up in relation to project procedures.

### 5.3. Parastatal corporations

Parastatal corporations are involved in almost all aspects of commercial energy supply, and including the ZCCM they also represent a very large part of the commercial consumption.

The corporations with direct involvement in the energy sector are shown in Fig. 5.2, and it might also be added that ZAFFICO is somewhat involved in charcoal production and certainly in more general wood supply questions.

The roles of the various corporations have been introduced indirectly in the description of the general energy situation in chapter 3, and the comments here will therefore be kept fairly brief.

ZIMCO's role and its political and commercial significance has been discussed in paragraph 4.4, the responsibility within ZIMCO

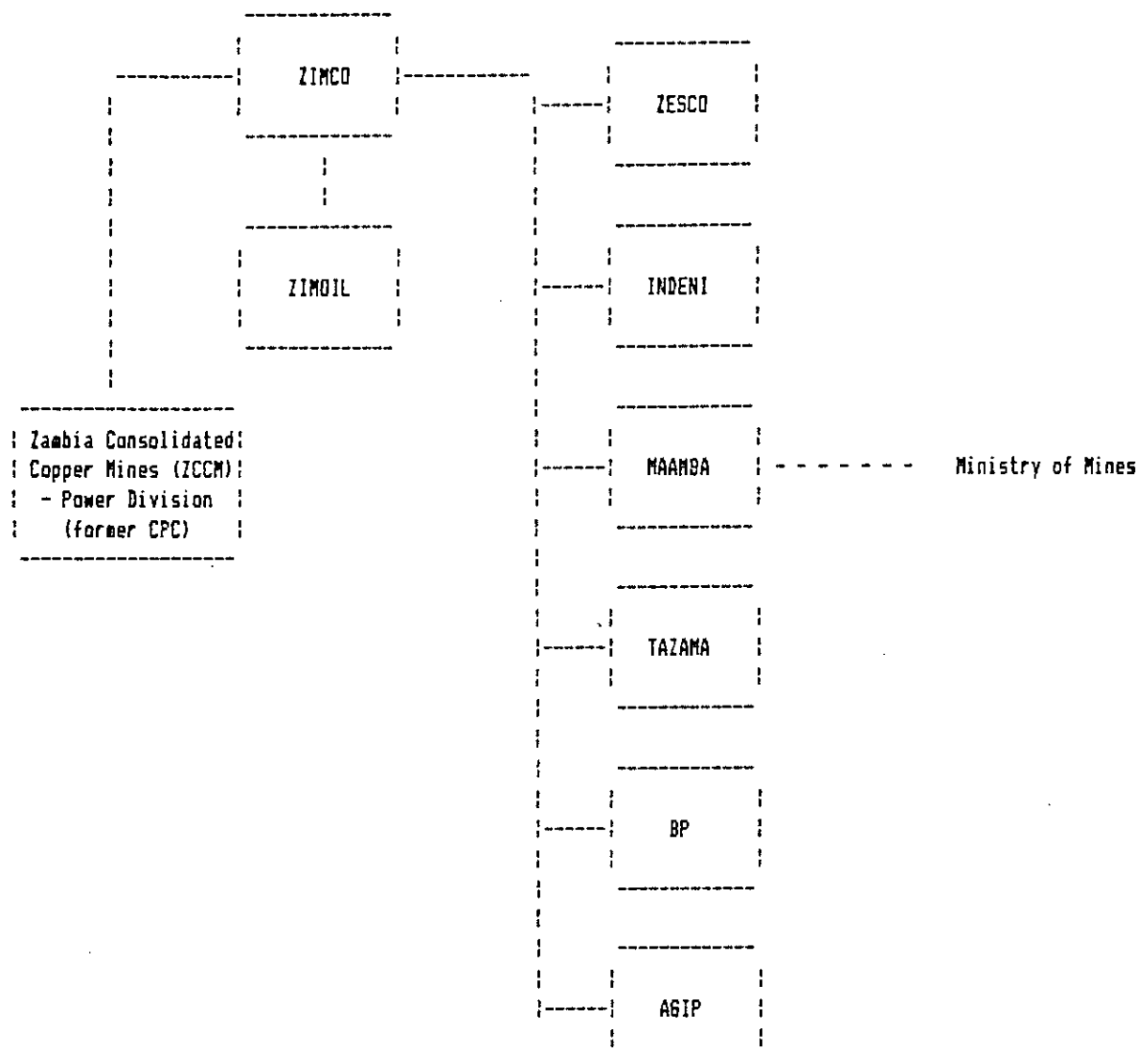


Fig. 5.2. Structure of the parastatal corporations in the energy sector

for the energy parastatals is in the hands of an executive director for transport and energy supported by a small secretariat.

ZIMOIL is a fairly new department of ZIMCO with responsibility for oil procurement, this task was earlier a part of Zambia National Energy Ltd (ZNEL) a wholly owned ZIMCO subsidiary, but the structure was changed in 1985, when ZNEL was abolished and ZIMOIL was established.



Staying in the petroleum supply Tazama Pipelines Ltd. is a jointly owned Zambian (67%), Tanzanian (33%) company responsible for the crude oil transport from the port of Dar-es-Salaam to the INDENI refinery (Petroleum Refining Company Ltd.) in Ndola. INDENI is owned by the Zambian state and the Italian oil company AGIP with half the shares each.

Distribution and retail sales of petroleum products within Zambia is handled by local affiliates of five of the large international oil companies BP, AGIP, Total, Mobil and Caltex. The two first companies are both jointly owned like INDENI, while the remaining three are independent of the parastatal structure.

Coal mining is the responsibility of Maamba Collieries Ltd., which is a wholly owned subsidiary of ZIMCO. As indicated in Fig. 5.2 the political control and coordination of Maamba is in the Ministry of Mines.

In the power subsector there are three major organizations involved. The Zambia Electricity Supply Corporation Ltd. (ZESCO), the Central African Power Corporation (CAPCO), and what was earlier the Copperbelt Power Company (CPC) now fully integrated into ZCCM as the Power Division. ZESCO is in principle responsible for all electricity supply in Zambia, but this is in practice limited by the functions of CAPCO and ZCCM/P.D.

CAPCO is a jointly owned Zambian/Zimbabwean corporation with responsibility for the Kariba Dam Hydro Power Station and some transmission systems in both Zimbabwe and Zambia, and ZESCO buys this bulk electricity supply and distributes it. The ZCCM Power Division is responsible for electricity supply and distribution to ZCCM and the towns on the Copperbelt, meaning that they actually buy and distribute between 60% and 70% of all electricity consumed in Zambia. This leaves ZESCO in a situation where a large part of both production and distribution is handled by other bodies, which from a ZESCO point of view is limiting the possibilities for both planning and action. ZESCO has expressed strong interest in taking over the present functions of CAPCO (Zambian side) and also the Copperbelt supply in order to

strengthen overall coordination and maybe also to avoid the present extremely low prices for bulk supply both for CAPCO export to Zimbabwe and for sales to ZCCM.

Overall policy coordination is mainly exercised through the ZIMCO corporate planning system. Furthermore the MPTC is represented in both ZIMCO through the minister and in the subsidiary energy corporations through the permanent secretary, and it is the ambition that the DOE through this representation should receive information and be able to influence policy.

The actual information flow is, however, totally dependant on the individual corporations' capability and will to present information. In practice the system of coordination is fairly weak, especially for projects or other activities where the companies use their own financial resources. If foreign donors or international banks are involved the project coordination system through NCDP, which will be dealt within more detail in the next chapter, provides better formal procedures for coordination.

#### 5.4. Advisory bodies

The National Energy Council (NEC) was as mentioned in section 5.2.1 established in 1980 with the mandate defined by an Act of Parliament as adviser to the Minister of Power, Transport and Communications on key issues of energy policy and planning. The NEC consists of twelve members coming from senior positions in private, governmental or parastatal organisations. The council has since 1984 been supported by a small secretariat.

Besides the advisory tasks the mandate of the NEC also includes data collection and compilation covering production, distribution, pricing and consumption of energy. Based on these data forecasts should be performed with regular intervals.

These very comprehensive tasks described in the Act are not in any way related to the resources of the NEC and the size of its

secretariat, and this difference between ambitions and realities has naturally caused some frustration both for the Council and for the staff in the secretariat. The creation of the Department of Energy was partly in response to this situation.

The mandate of the NEC has, however, not been changed after the establishment of the DOE, and this has caused a lot of friction between the two institutions. The results of this friction have among other things been lack of coordination of activities, reluctance from council members organisations to collaborate with DOE etc.

It is, however, a fact that DOE with its organisational status as operational tool for the Minister has gradually gained recognition as the energy planning body e.g. expressed through the function as secretariat for the Energy Sector Committee in the FNDP work. This has perhaps not removed the frictions between the two bodies, but it has reduced the consequences.

The NEC's main future function therefore seems to lay in its basic role as high-level adviser on general energy policy matters.

In a situation where government resources are scarce, collaboration between sector institutions is absolutely essential, and hopefully the situation will gradually improve.

With the creation of the Energy Sector Development Planning Committee and its two sub-committees respectively on commercial energy and on rural and household energy an important coordination forum was established. The Committee includes members from all relevant ministries, NEC, ZIMCO, UNZA, private industry, etc. The Committee should continue also after the presentation of the FNDP to monitor the implementation of the plan. Due to present uncertainty about the FNDP, the future role of the Committee remains to be seen.

There are and have been various other committees with relevance for especially woodfuel resources, but since they are not directly related to energy policy and planning, they will not be described here.

### 5.5. Research and development institutions

The University of Zambia (UNZA) is active in research, which is both directly and indirectly related to energy supply and consumption. The School of Engineering and the Technology Development and Advisory Unit has for a number of years been working with energy technologies, in particular improved charcoal stoves and renewable energy technologies (wind-pumps, solar-dryers, mini hydro, etc.). Furthermore, they participated in the National Energy Survey together with NEC and to some extent also DOE. Other departments at UNZA are working with activities that are more indirectly relevant to the energy sector.

Within the Forestry Department are a Forest Research Division and a Forest Products Research Division. These divisions perform research and testing of charcoal kilns as a part of their activities besides the more directly forestry management related research. With support from FAO the Forestry Department is performing the nationwide "Wood Consumption and Resource Survey".

The National Council for Scientific Research (NCSR) acts both as advisory and funding body and as project performing organisation. In the energy sector the NCSR is mainly active in renewable energy technologies e.g. biogas and in woodfuel conservation and substitution projects like the suggested coal briquetting plant, where coal slurry from the Maamba mine is suggested as base material for new briquettes to substitute charcoal in some urban areas. The project proposal also includes a new ceramic stove production.

Funding is, however, generally very sparse for research activities. The above examples are almost entirely funded by foreign donors, and it is usually very difficult for Zambian institutions to obtain sufficient funds for their work in international research collaboration.

#### 5.6. SADCC cooperation

The regional cooperation within the SADCC framework was founded formally in 1980, and the member countries are Angola, Botswana, Lesotho, Malawi, Mozambique, Swaziland, Tanzania, Zambia and Zimbabwe. As indicated in the name of the organization the main aim has been to coordinate activities within the member countries in order to strengthen collaboration activities and utilize the limited available financial resources better.

The institutional structures of the SADCC organisation include on the overall policy level:

- The Summit
- Head of State Meeting
- The Council of Ministers
- Standing Committee of Officials
- General Secretariat
- Sectoral Commissions.

A number of high priority areas/sectors have been identified and each member country has been given responsibility for the coordination of one of these tasks. More details about the structure and history of SADCC can be found in Torstenson (23). Energy is one of the sectors that has been given priority and Angola is responsible for the coordination of activities in this field covering all aspects of energy development. The work is institutionalized in a Technical and Administrative Unit (TAU) in Luanda and it is governed by regular meetings of joint SADCC Energy Ministers and Officials.

The work in the TAU has mainly been concentrated around building up knowledge and a data basis about regional energy production, distribution and consumption in order to be able to initiate and coordinate activities of interest for the member countries. Another important aspect of the coordination is that project proposals of regional interest can be forwarded by the individual countries or by TAU, and if they are approved by the Meeting of Energy Ministers and Officials, these proposals will be pre-

sented as SADCC projects to interested donors at an Annual Consultative Conference.

Seen from a Zambian energy policy point of view, the impact of SADCC's energy activities is still quite limited. The experience has often been that SADCC initiated activities were performed without proper coordination with the responsible national institutions (MPTC and DOE), and results were not reported. It is difficult to judge whether this is due to lack of information from the TAU, or it is bad communication in Zambia between the involved high level representatives and the staff in the policy level institutions.

Relations do, however, seem to be improving, and the activities at regional level may become increasingly important for policy and planning in the individual member states. This assumption is supported by the fact that many donor countries are very positive towards supporting both the institutional structure of SADCC and the presented projects of regional interest.

## 6. PROJECT PROCEDURES

### 6.1. Introduction

The general introduction to the energy situation, the national planning system and the more thorough presentations of the involved institutions in the energy sector provides the background for a description of both the formal and informal procedures established for project handling. The description is naturally focused on energy related projects, but it may be expected to have general validity also within other sectors of the Zambian society. A thorough understanding of these procedures and the administrative system is one of the essential factors for the discussion of project analysis methods and the selection process to be presented in the volume three report of this study.

A very important aspect that has not been mentioned yet is the sources for funding of project activities and the special role of foreign donor organisations. With the growing economic problems within the country, the importance of foreign funds for project financing is steadily increasing, and this also influences the project procedures, particularly on the informal side. For the sake of simplicity the description here will look at donor financing in general terms, although it is evident that there are considerable differences between the various agencies of the individual donor countries, the international development banks, the United Nations organisations, etc. The differences at the policy level include for instance general sectoral policy priorities, types of restrictions on the funds, for instance loans or gifts bound to purchases in the donor country. On the sector level, differences are mainly related to how directly the various organisations try to influence policies and priorities. Within the energy sector this can be exemplified by the UNDP/World Bank Energy Sector Assessment program (ESA), where these organisations perform a comprehensive study of the energy sector and end up with recommendations for both policy and investment plans reflecting the development policy views within their own organisations. This is one extreme with great implications, at the other end of the scale there is the small donor country that only presents some general areas of interest and is willing to make adjustment according to specific needs.

These large differences are naturally reflected in variations in project procedures. But in this context the distinction is, however, only between projects funded by domestic (government, parastatal, company) sources or by foreign sources, because this is the aspect with the clearest influence on procedures and also because a description of the impact of the mentioned differences between donors would require a whole study of its own.

The procedures for promoting projects at the regional level through the TAU of SADCC have not been fully established, and practical experience is very limited. Therefore no attempt has been made to describe the possible procedures.

The ambition was from the beginning to focus this description on rural energy projects or expressed in another way rural development projects with a clear energy component. The experience in Zambia with this kind of projects is, however, still very limited and mainly of a research character, so in order to get a clearer picture of the procedures, the description will be kept in general terms with energy projects as examples.

## 6.2. Project ideas

A large number of different sources of project ideas and proposals can be identified, and as it is discussed later in this chapter, the type of source may have big influence on how the suggestion is handled.

The sources can be divided into at least 5 general categories.

### Politicians

Ideas from various levels of the political hierarchy. Starting from the "bottom" with local politicians who want to promote a project in their own constituency through letters to the Minister, personal contacts in Parliament etc. A proposal may consist of anything from a problem description to a formulated project prepared by for instance, the Provincial Planning Unit.

At the national level Members of Parliament or other high level party members may act in a similar way to the above described, or they can address the Government or high level official in the relevant ministries more directly. Highest priority is naturally given to proposals coming from the Office of the President, and project procedures may be quite "simple" in these cases.

### Administration

Project proposal will often be a natural result of planning activities in ministries or departments. It may take the form of supporting studies for the internal activities e.g. data collection, method development etc. or solutions to problems identified through the planning activities. Frequency and project



type will vary considerably between the various sectors depending on the administrative setup, defined responsibilities etc. Examples from the energy sector of the first type of "support-projects" could be the installation of the LEAP model to support the planning efforts in DOE, while projects of the second type are difficult to identify at this stage, but may be expected to be more frequent, when planning efforts progress further.

#### Parastatals and private enterprises

Due to the size and very central position of many parastatal corporations, they are evidently a large source for project proposals. Smaller projects are typically handled within the company, just as an ordinary private enterprise. But since many of the parastatals are responsible for activities of key importance to society, and their economical activities often politically controlled, larger projects for development, extension or rehabilitation have to be funded by sources outside the company. There are many examples of this within the energy sector like the power station and grid extension programmes in ZESCO, rehabilitation of the TAZAMA pipeline and the Maamba Colliery, and many more. The original idea for the projects may come from sources outside the company typically as a political decision but this is not important for the procedure discussion here.

Private enterprises will of course not be a source for project suggestion in the same way as parastatals, but if their activities are of major importance, support may be given through project activities. Infrastructure development is one of the clear examples of this type of project support. The idea or wish may be presented by either the enterprise through official channels and political contacts or by local politicians, as it was described earlier in this chapter.

#### Research institutions

Specific funds for research activities are in general very limited, and since many aspects especially concerning rural devel-

opment are still largely unexamined, research activities ought to have quite high priority as input and support to planning activities. Suggestions may emerge as results of on-going research programmes, identification of problem areas etc. or like the action programme set up by the UHRED section at DOE, where a number of projects of a research and demonstration character is outlined.

#### Foreign sources

The general influence of donor agencies, international organisations etc. has already been mentioned earlier in this chapter. The UNDP/World Bank ESA programme has with its activity recommendation had a large influence on what type of projects are being promoted. Funds from these organisations will usually be restricted to activities identified through their own studies, and other donor organisations may also use these studies as a basis for negotiations. These large international organisations are the ones that interfere most directly with presentation of project suggestions. Many of the agencies of the individual donor countries work more indirectly, where general priorities and experience with certain types of activities may result in suggestions for new similar activities.

The agencies' role as a source of support for their home countries' commercial interests will, however, often mean that they play an active role as promoter of certain project ideas. This also implies that foreign commercial companies often are very active in presenting and promoting project ideas where they could take part.

#### 6.3. Formal project procedures

The formal procedures that have been set up are closely related to the source of the funds, and generally speaking there are three possibilities. Funds can come from:

- the institution's ordinary budget
- central government programmes
- foreign sources.

In the first case activities will usually be limited to areas central to the institution's responsibilities and due to the present economic situation also usually limited in scope. Ideas will usually emerge as result of ongoing activities within the institutions or directly from the responsibilities or duties invested in the institution. The commercial parastatals may have quite a substantial number of this type of projects.

In principle planning, selection and execution are performed within the institution, but it applies to almost all government agencies and parastatals that these activities have to be in accordance with yearly plans and maybe also long term/5 year plan objectives. This accordance will usually be controlled by a coordinative authority e.g. the sector ministry, ZIMCO etc. This system should in principle secure coordination and political acceptance, but the resources available for supervising and planning in the coordinative institutions are limited, which means that in practice coordination may be insufficient. With the limitations on this type of "internal" funding, the consequences of any lack of accordance will, however, not have too large impact on the general development in society.

The second and third type of funding is often closely connected in the sense that many projects are financed through a combination of the two sources. Many donor agencies demand a minimum percentage of local funding in the projects, they support, while others may be willing to be responsible for all expenses. Almost all major projects within the energy sector have been financed through a combination of government and donor contributions.

Ideas for projects may come from any of the sources described in the previous section, and this may affect the project administration in practice, but in principle the procedures are the same.

Ideas and proposals are gathered in the sector coordination bodies, which may be ministries, ZIMCO or other institutions

with similar responsibilities. The suggestions may be anything from the identification of a problem or the outline of an idea to a complete proposal with all details described. The coordination institutions must then in principle prepare the suggestions and bring the descriptions to a level where analysis and selection can be made. The resulting proposals must then be analyzed against the general criterias for the development within the sector determined by the overall long term planning objectives. The annual and the five year planning system is the framework for this analysis and selection, but it can be very difficult to transform the usually very general policy statements and objectives into a practical set of criteria.

In order to secure overall coordination between the various sectors and probably also with the ambition to apply a set of fairly uniform selection criteria and keep an unambiguous line of command, all projects where foreign or special government funds are requested must be submitted to the NCDP. All official contact to foreign sources of funding has to go through NCDP, and they are responsible for trying to find and raise the interest of a potential donor. This contact is based on both day to day working relations and on yearly consultations, where the official structures for the collaboration are discussed.

Political and organisational conditions for these negotiations will not be discussed further here in the Zambian administration context. But it is important to be aware of the impact of these conditions on the criteria used for analysis and selection both at NCDP and on the sector level. This aspect of project analysis will be resumed in the next volume, where the focus will be methodological aspects of project preparation and analysis.

#### 6.4. Practical project procedures

The above described approach to project administration has presented a stiff bureaucracy with defined functions and formal lines of communication. This is not entirely wrong, because in

practice it may in some cases also be how things are actually done. But an examination of the practical procedures reveals a network of established "informal" contacts between sector institutions and foreign donors, personal, political, and tribal relations between people in the various bodies etc. All these "informal" contacts are naturally of great importance to, what procedure an actual project proposal has to follow, and must be considered when methods and criterias for project analysis and selection are being discussed.

This situation is in no way special for Zambia or developing countries, it is probably a part of almost all working bureaucracies. The obvious examples are proposals coming directly from ministries or other high ranking politicians, where the people responsible at the administrative level very seldom can do anything else than performing their best to support the request. This type of proposal is, however, usually limited in number and may be considered as exceptions from the actual working procedures.

The difference between principal and practical procedures that probably have the largest effect on the final selection is the often very early contacts between the sector institution and the foreign donor. It is normal practice at least in the energy sector to look for interested donors at a very early stage in the project preparation process. Both the clearly expressed and to some extent also the underlying interests of the individual donors are quite well known, meaning that the sector unit staff usually has a good idea of which donor would be relevant to contact, and what is the right way to create interest. If the response is positive the idea must be further elaborated and a more precise proposal prepared.

The formal procedure with NCDP coordination still has to be followed and the proposal is forwarded to NCDP from the sector institution, but now also with a suggestion of, who could be a relevant donor. The donor will usually receive a copy of this paper and will generally be at least unofficially committed to the project at this stage.

In this situation NCDP's review and analysis of the project will be limited and a formal request on behalf of the Zambian government will be drawn up and forwarded to the interested donor. Depending on how thoroughly the proposal has been prepared, the donor will study the content against their own set of criteria.

Because of the tight restrictions on both manpower and economic resources for studies, the level of detail in the proposal is, however, often limited. The donor may then want a feasibility study of the project before any agreement on the main project can be reached. If this study confirms the basic conditions for the project, the process continues. The study may indicate or suggest some changes, and these have to be negotiated with the sector institution. If the changes are of a central importance, it may lead to objections, but since the donor can make participation conditional on the changes, suggestions are normally accepted and a revised project description is produced. Based on this description an agreement is usually reached between the two parties to continue with the project preparation.

Depending on the detail of the feasibility study the final appraisal of the project may either be based on the data from the first study, or the donor may choose to finance an appraisal study, where e.g. a consultant is hired to make an investigation of the conditions for implementation in the field and assess the economic, financial, technical, and institutional feasibility of the project.

The emphasis on the different phases of the process varies between the different donor agencies and naturally also with the dimensions of the project. It must, however, be noted that the period from the first contact between the sector institution and the donor and until a final decision to start the actual project is taken usually takes from one to two years, and if there are problems on the way the period can easily be longer.

The result of the appraisal phase provides the background for the final agreement where details about responsibilities, fund-

ing, administrative routines, reporting etc. are defined and signed by NCDP and the donor often as a part of the annual high level consultations at which the general framework for the total assistance is discussed.

This description has in very general terms aimed at showing the "standard procedure", and there are of course a number of variations to it and regular exceptions like the example given earlier. The most common variations can be divided into three categories.

- The proposal has not been informally presented to any possible donor, and domestic funding is not available, either from any institutional budget or from a government programme. The procedure followed in this situation is then typically the described formal one, and the proposal will be forwarded to NCDP, who may try to find a donor, if the project is given priority. Another possibility in this situation may be to present it to SADCC through the meeting of Energy Ministers and Officials, if the proposal can be said to have some regional interest. As mentioned earlier this procedure has not yet been fully established.
- NCDP may as a part of preparation for the yearly consultations request the sector institutions to try to find project ideas that match the often well known priorities and interests of a specific donor organisation. Preparation will usually be very brief, but the essential aspect is at first just to see, if there are possibilities, and then the described process of studies etc. can improve the suggestion.
- The donor agency or a commercial company from the donor country may either individually or together present a proposal to NCDP or more often first to the sector institution. This resembles the discussion of where the ideas come from, but the essential aspect is that the preparatory work and preliminary donor contacts are usually taken over by the company and the sector institution's influence is limited.

These variations are all in the early phases, where the first and often a very important part of the selection process is being performed. The design and appraisal phases are naturally also important and the methods and criteria applied have great impact on the actual design of projects for execution. The main difference is probably that methods and criteria for design and appraisal are being studied and developed, while the impact that the initial selections and the implications of the early donor contacts, the different sources for proposals etc. have on the selection process, are often unrecognized.

This will be discussed further in the next section along with the methods used at the various stages of the practical procedures.

#### 6.5. Analysis methods and criterias

The description of both the formal and the practical project procedures reveals three main levels of project preparation and analysis:

- sector level
- national level
- donor level.

The order in which the three levels are mentioned refers to the chronology in the project procedures and is not any priority ranking of the decision levels.

The preparation and selection activities at sector level are only to a very limited extent based on detailed analysis. This might be specific for the Department of Energy being a very new institution with limited resources, but a number of the background reasons are of general validity for most government institutions. These include lack of sufficient staff and financial resources for the field studies, sparse information, etc. It may therefore be expected that the situation is rather similar in other sector coordination bodies.



If the Rural Electrification Programme administered by DOE is taken as an example, the preparation activities usually include collection of available data about the township or area that is considered for electrification. This is generally limited to what is available in public statistical material, where only very aggregate and often outdated figures are presented. In some cases it is possible to supplement statistics with a short field visit mainly to verify the validity of the general data. Technical data about the supply side is given by ZESCO and will usually include cost estimates for the major activities.

If a new area is to be electrified and not "just" substitution of old production facilities, it can be very difficult to estimate revenue and other benefits, and usually expectations are based on general experience from other electrified rural areas without looking at the specific conditions for the selected area.

If selection between more projects or alternatives is necessary, it is based on an economic and financial analysis using criteria like net present value and/or internal rate of return. With the available data and their quality in mind this type of calculation only has a real value when different technical solutions for the same project or various substitution projects of the same kind are being compared, e.g. two different diesel engine types.

The more basic questions of what problems the project is trying to meet, who are the desired and the actual beneficiaries, etc., are never asked or analyzed. In this specific case it may be explained by the fact that the electrification programme is a specific government activity, where the tasks are already given. The procedure and the methods used are, however, the same when other activities are being considered.

This is not intended to be a critique of the way the institutions perform their analysis, because that is closely related to their practical possibilities. The aim is merely to point out the limitations and consequences of this situation.

Analysis and selection at the national level in NCDP is usually limited, as described under the practical procedures. Projects are approved on the basis of the sector institution's recommendations supported by donor interest. In situations where projects are presented to NCDP through other channels, the task of analyzing the project will be NCDP's, and the practice then is to base the analysis on the general methodology presented in UNIDO's Guidelines for Project Evaluation (27). These guidelines present a comprehensive cost-benefit approach, where various levels of social costs and benefits can be included. It is suspected that the actual use of this method is kept on a limited scale, where only the direct costs and benefits are included, narrowing the analysis down to a manageable size. If a major project of paramount importance to society is being considered, analysis will naturally be more comprehensive, but it will then usually involve one of the international organisations, and they will traditionally be engaged in the process of preparation at a very early stage and more or less take over the analysis tasks.

This leads on to looking at analysis and selection at the donor level.

As described in the introduction to this chapter, there are large differences between the various UN organisations, the international development banks and the agencies of the individual donor countries. The differences cover all kinds of aspects from general development theory perception, types of sectors and projects supported, ways of interaction with the respective governments etc., down to also procedures concerning studies and project selection and analysis methods.

The basic structure with feasibility studies and even pre-feasibility studies followed by detailed design and description and then an appraisal of the projects is common for most organisations and most projects. Many of the organisations do, however, have their own handbook, guide or something similar for how these studies and analysis activities should be performed, what aspects should be considered etc. Experience drawn from the Zambian energy sector indicates that both in the analysis work

and as a selection criterion economic and financial cost-benefit methods have a central position. Technical viability is also given high priority, while other less quantifiable aspects like social, cultural and environmental impact are given much less attention.

This experience is especially connected to the international banks and UN organisations, while some of the individual countries' donor agencies gradually try to include also some of the less quantifiable aspects in their analysis.

It is evident that at all the three described analysis levels high priority both in the analysis and the selection phases is given to the economic and financial aspects mainly through the more or less extensive use of cost-benefit methods.

The seeming accordance in the use of costs-benefit methods must to a large extent be seen as a result of donor influence both directly through their own use of these methods, when deciding whether or not to support an activity and also in many indirect ways like e.g. training programmes, support to research in these methods, provision of manuals and computer programmes to support this type of analysis.

As described in this chapter, the methodology used is only one aspect of donor organisations exerting influence on project preparation, analysis and selection. Influence is exerted in many other ways. Especially the consequences of early donor involvement in the preparation phase seem to be important, because this often leads to a situation where it becomes a major objective in the project preparation to make the project acceptable to the donor, even if it means neglecting part of the sectoral interest in the project.

It seems therefore from a Zambian point of view desirable to avoid or at least minimize this early involvement of the donor and strengthen the local engagement in preparation, analysis and selection of projects. Account must still be taken of the generally known preferences of the donor organisation. Within this

framework, however, greater local involvement would hopefully provide better possibilities for gaining influence on which projects will finally be executed. It will also give a chance to adopt a broader range of methods and criteria and give higher priority to some of the earlier mentioned qualitative aspects.

Since the administration still suffers from constraints on both manpower and financial resources, it was considered that a small computer tool could support the possibilities of increased local engagement in the preparation and analysis. Therefore a small and fairly simple computer model has been developed as a part of this project. This tool is presented as a major part of the volume three report.

If it is not possible to increase the local involvement in the preparation and analysis activities, another viable way would probably be to engage in closer collaboration with a limited number of interested donors on both policy planning and project preparation and execution. This would not mean less donor influence on decisions, but it would at least in principle secure more consistent planning, since it would not be necessary to find new donors for each activity.

## 7. CONCLUDING REMARKS

The description of the Zambian energy sector reveals that many successes have been achieved especially during the first fairly prosperous decade after independence. The actions were, however, mainly aimed at the supply of commercial energy sources and reduction of fuel import. Moreover the achievements were almost entirely for the benefit of the mining and industrial sectors, the commercial farmers and the small wealthy part of the urban population.

The large majority of the population living in the urban settlements and the rural districts has not benefitted from the results, indeed they are still almost totally dependent on the traditional energy source - woodfuel.

There is, however, a growing national and international recognition of the importance of woodfuel both for the individual families and for society as a whole, and along with that also a wish to try to understand the underlying informal social structures. This task is naturally not an easy one, since most woodfuel problems are basically reflections of poverty and lack of development, and can therefore not in any way be addressed only as energy problems.

This recognition has unfortunately not yet resulted in any major policy actions. The vast majority of activities within the energy sector is still aimed at commercial supply mainly through rehabilitation and expansion of the existing structures for supply of oil, coal and electricity.

If there is going to be any change in this situation, it is essential at the policy level to establish close collaboration between all relevant institutions responsible for e.g. energy planning, agriculture, forestry, rural development etc., because as already mentioned the problems have to be addressed through integrated and interdisciplinary action. The need for coordination and collaboration is emphasized by scarcity of funding available for activities in the present economic situation. A first step towards this type of interdisciplinary approach was made during the preparation for the FNDP through the establishment of the Subcommittee for Rural and Household Energy, but mainly due to staffing problems it has not been continued.

The ambition in this report has not been to try to present solutions of how to address these problems at the policy level, but mainly to describe and analyze the existing situation and present some of the historical, political and social background. In the volume three report one aspect of planning and policy

execution will be dealt with in detail, namely the methods and criteria used in project analysis and selection. The report will discuss the commonly used economic methods, their impact on selection and their limitations. An alternative approach will be presented, where a broader set of parameters including social, cultural and wood resource aspects are being suggested.

This is naturally only one small aspect of the whole complex of problems, but as discussed in chapter 6, it aims at one of the important parts of the planning process.

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**Abstract (Max. 2000 char.)**

The energy situation in Zambia is described in detail following a general introduction to the Zambian society. The contribution of the different commercial and woodfuel energy sources to the energy supply in the different sectors is analysed and policy options outlined.

The political and administrative structures especially within the energy sector are presented, and the existing formal and informal project handling procedures are analysed.

The present situation is generally characterized by limited Zambian influence on project analysis and selection, while foreign donor interests are found to have great impact through very early involvement in the identification and preparation phases.

**Descriptors - EDB**

ENERGY CONSUMPTION; ENERGY MANAGEMENT; ENERGY POLICY; ENERGY SUPPLIES; PLANNING; RURAL AREAS; SOCIO-ECONOMIC FACTORS; ZAMBIA